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# DEFENSE

JOURNAL

VOL 13, NO 4 | JULY/AUGUST 2021



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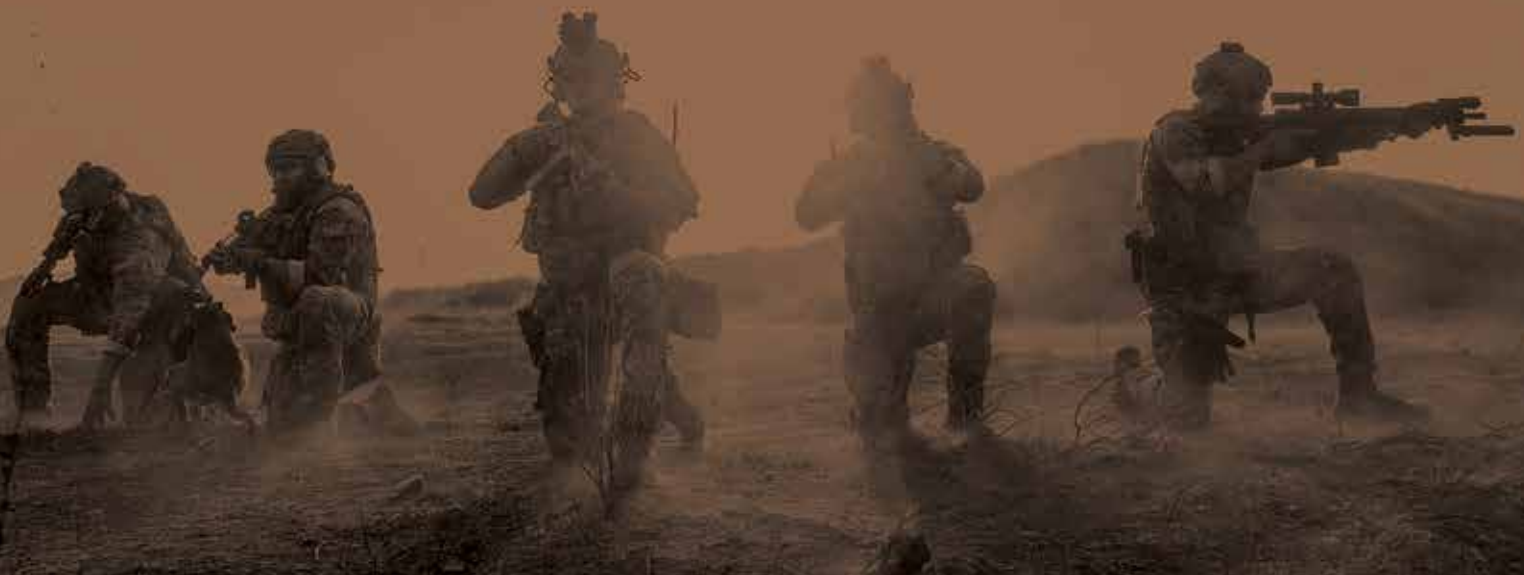
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PHOTO: OLEG VOLK

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# NEW PRODUCTS



## TASMANIAN TIGER

### ***TACVEC Series Products***

The TACVEC series of products are designed for use in police and SWAT vehicles providing instant accessibility, customization, modularity and scalability of medical, tactical gear and tools.

**TT TACVEC Container** is for storage and emergency gear. The bag is divided into three parts with hook-and-loop, color-marked and writeable strips for product identification. Easily stored and fastened under the front seat for quick access, the TT TACVEC Container can be work bandolier-style while on a mission. It has MOLLE hook-and-loop on the back and a flap with hook-and-loop with quick-release fas-

teners. There are two carry features on the bag, one is a carrying strap that is adjustable and removable, and also a hand-held, durable handle. Perfect for tactical and military vehicles, the TT TACVEC Container bag also makes an ideal civilian bug-out bag. Available in Black or Carbon for an MSRP of \$109.00.

The **TT TACVEC Pouch 1**, a quick-release equipment bag that attaches to the TT Front Seat Panel with a Zipper adaptor. The 12" x 11" x 4" bag has plenty of storage room inside the pocket with MOLLE hook-and-loop and elastic loops for organizing gear. Because of

its size, the TT TACVEC Pouch 1 must be used solo on the TT Front Seat Panel as it cannot accommodate the Pouch 1 and the TT Weapon Fixation. Available in Black or Carbon for an MSRP of \$89.95.

The **TT TACVEC Weapon Fixation**, a height-adjustable, long-barrel firearm holder for use on the TT Modular Front Seat Panel. The weapon is attached and secures with hook-and-loop or with a quick-release system. It cannot be used in conjunction with the TT TACVEC Pouch 1. Available in Carbon only for an MSRP of \$59.99.

**[tasmaniantigerusa.com](http://tasmaniantigerusa.com)**



DIAMOND AGE

## NeoSteel™ Tactical Helmet Now Available in Full-Cut Option

Texas-based materials science and ballistics specialists, Diamond Age, are pleased to announce the **Full-Cut model option** of its next-generation steel **NeoSteel™ Helmet**. Designed to offer maximum coverage, the Full-Cut option meets and exceeds VPAM-3+ Special Threats ballistic requirements. The ACH-style helmet is a modular combat helmet produced using the most technologically advanced metal alloys offering all-day comfort, balance, protection, and, unlike the current K-pot polymer-produced helmets today, will not degrade over time thus weakening its protective capabilities.

In addition, Diamond Age has reduced lead time for products to meet the demand of its customers without sacrificing on materials, technology or performance. The new Diamond Age NeoSteel Full-Cut, as well as the High-Cut helmets and Face Protection Module, are currently in stock and will ship within days rather than weeks.

The NeoSteel Helmets are an evolution in personal protection offering the lightest possible weight at 3.25lbs with high levels of ballistic performance in a steel helmet. NeoSteel Helmet offers best-in-class performance for minimal backface deformation (BFD) and impact trauma. Unlike current polymer-based helmets, the NeoSteel is also environmentally stable, providing users years of consistent rim-to-rim protection, without material degradation that would severely compromise protection performance.

Diamond Age has spent years of research and rigorous developmental testing to arrive at a tactical helmet designed to meet the requirements and needs of combat environments, as well as being an affordable personal protection helmet for civilians.

Diamond Age NeoSteel Helmet in Full-Cut or High-



Cut is now available in Black, Foliage Green, or Tan and in Medium or Large/Extra-Large (Full-Cut available in Large/Extra-Large only) for an MSRP starting at \$195.00 without accessories.

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# NEW PRODUCTS



FN M3M WM (Weapon Mount)

FN HERSTAL

## New Land & Sea Weapon Mounts

FN Herstal's Land and Sea portfolio now includes highly modular systems designed around FN® machine guns from 5.56mm NATO caliber up to .50 caliber.

The **FN® M3M WM (Weapon Mount)** is a dedicated mount for operating the .50 cal FN® M3M machine gun. Designed around the FN® M3M characteristics including the high rate of fire (1,100 RPM), it provides exceptional accuracy on target and is the only qualified weapon mount for use with the exclusive .50 cal FN® M3M/GAU-21 machine gun. The FN® M3M WM provides the operator with the following key benefits:

- Fully mechanical operation (no electrical power required)
- Mk16 MOD 8 type 0.50" large pintle interface as standard
- Buffered system to reduce the weapon recoil forces transmitted to the platform
- 300-round ammo box
- Two distinct firing triggers for left- or right-hand operation
- Large angles of operation, i.e., elevation: +60°/depression: -20°
- 3 Picatinny type rails for optics/lasers etc.
- Optional front armor shield providing ballistic protection up to STANAG Level IV Fully qualified weapon system to MIL-STD-810 standard

To provide the user with a mounting for a full range of

light and medium machine guns, FN Herstal also proposes the new **FN® Light MWM (Multi Weapon Mount)**. This system accepts any FN Herstal 5.56 and 7.62 caliber machine guns in many configurations (i.e., FN MAG® Infantry version/ FN MAG® 58M, FN® M240 Versions D, H & L, FN MINIMI® 7.62 [Mk3 and previous versions]/ FN® Mk48, FN MINIMI® 5.56 [Mk3 and previous versions]/ FN® M249).

The FN® Light MWM provides the operator with the following key benefits:

- Fully mechanical operation (no electrical power required)
  - NATO G3 cone interface as standard
  - Buffered system to reduce the weapon recoil forces transmitted to the platform
  - Ability to change weapon configuration in minutes
  - Large angles of operation, i.e., elevation: +50° / depression: -60°
  - Lightweight: 8.5kg
  - Fully qualified weapon system to MIL-STD-810 standard
- To meet the specific mission and platform needs, a full range of options is available to enhance operational performance:
- Links & case collector (250- or 500-round capacity)
  - Depression angle limiter
  - Ammunition pouch interface (7.62mm/5.56mm)
  - Platform specific interface sleeves

**fnherstal.com**



## MEPROLIGHT

### MEPRO O2 Red-Dot Sight

Meprolight is launching the **MEPRO O2 red-dot sight** (MIL-SPEC), offering a breakthrough and significant tactical advantage using, a 5 segment reticle which allows to pre-set numerous aiming patterns, to all tactical scenarios and different ammunition (for example, quick transition between reticles when moving from 300 Blackout subsonic to supersonic ammunition).

Users in the defense, law enforcement and HLS sectors benefit from advanced features such as small dimensions, light weight (approx. 280g), and a built-in light sensor and automatic brightness control system that enables clear visibility of the red dot in any lighting conditions—a significant advantage for accurate firing.

The MEPRO O2 sight also includes non-reflective optics without light signature toward the target, for enhanced force protection; a combination of an integral motion sensor and configurable sleep time of 4-8 hours, saving power for extended operation; a new, improved, rugged MIL-SPEC mounting design and a protected three-button control keypad.



"The MEPRO O2 sight is an innovative addition to Meprolight's ever-growing range of small-arms aiming solutions," says Benny Kokia, VP Sales & Marketing at Meprolight. "For the first time, the user can now choose an optimal reticle from four pre-set aiming pat-

terns. Our goal in developing this new sight was to provide armed forces with a significant tactical advantage, through capabilities that deliver mission flexibility and target precision, along with extended operation time." [meprolight.com](http://meprolight.com)



## FOXFURY

### Breakthrough® BT2+ Hybrid Light

**FoxFury Right Angle Lights** are the perfect lighting tools for search and rescue. All Breakthrough® lights feature compact size, bombproof & waterproof construction, powerful tight beam and large on/off button that's usable with gloves.

The versatile FoxFury **Breakthrough® BT2+ Hybrid Light** delivers a far-reaching 700 lumen beam. From locating lost victims, to long-range inspections, to signaling—the BT2+ focused beam helps the rescuers see better and respond faster, especially in thick smoke and fog. The Breakthrough® BT2+ light is submersible, fire-resistant and available in black or orange.

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The new Grail Rifle with a Trijicon VCOG 1-6x24 scope.

# The SLR15

## Optimized for Dangerous Situations

Story & Photography by Oleg Volk

**W**ho would you ask to design your AR-type rifle: a SWAT leader and trainer or a professional gunsmith and armorer? If you picked “both,” welcome to SLR15! Their rifles are configured and designed by Greg Sullivan, a man with thirty years of SWAT experience and almost as much in designing armorer’s tools, training armorers and working on AR-type rifles. Greg has also been running The Defensive Edge training group for almost as long. When I took their shooting classes in the early 2000s, they were already well-established with a national reputation.

Greg Sullivan, or “Sully,” has been producing rifles since 1994 (under the “SLR15” brand since 2003).

From that confluence of experiences came the original SLR15 Grail Rifle in 2009. Since then the concept has been refined to reflect both lessons learned and the changes in optics and other firearms accessories. In the first fifteen years, Sully collected and analyzed a lot of statistical and anecdotal information, added his hands-on SWAT experience and formulated the requirements for a rifle for law enforcement and self-defense. Some of the ideas came





# Grail Rifle

from *S.W.A.T. Magazine* publisher, Rich Lucibella. Here's a partial list of requirements:

- Reliable with a wide variety of ammunition.
- Durable, won't break if dropped or struck.
- Accurate mechanically and practically.
- Non-snag, works with body armor.
- Well-balanced, ergonomic, can be controlled with one hand if necessary.

Reliability is key, so all high-stress parts are individually checked for flaws. Since extraction problems are the

number-one concern with AR-type rifles, the rifle uses an upgraded forged, nickel-plated extractor with an enhanced spring. The magazine well is slightly wider than standard to allow for variation in magazine dimensions.

The telescoping stock with an aluminum tube is a known weak part of the M4 carbine design, so Grail uses a solid urethane "Sully" stock—another original part of his design. Providing just over an 11-inch length of pull, this clubfoot stock has a well-rounded, solid-textured buttplate, so it can be used with armor without forcing a bladed stance or



#### Solid Sully stock.

snagging on gear. Heavier than the usual telestock, it locks into the rear of the lower receiver to protect the buffer tube from deformation. In addition to its primary purpose, the Sully stock can be used to break through obstacles, such as auto glass, with no fear of damage to the gun. The butt-

stock has two QD receptacles on each side for the sling, but there's no front opening. A Magpul Picatinny-mounted RSA® QD Rail Sling Attachment takes care of that.

The accuracy requirement was met with a 16-inch Lothar Walther 1:8 medium-light chrome-lined barrel. While the

#### Greg Sullivan holding the original Grail.







chamber is Mil-Spec 5.56mm and the barrel isn't target weight, reliability and handling get first priority. Thanks to the quality of manufacturing, the stress-relieved barrel turns in highly-respectable result anyway. With match ammunition, the rifle shoots under 1 MOA, with most defensive loads in the 1-3 to 1.5 MOA range and practical ball around 2 MOA.

Johan Boden of Federal Ammunition described his test results thus:

*Between 1/2" and 3/4" with 69gr Federal Gold Match. Very healthy gun. Brass goes into a pile at 4 o'clock. Zero pressure signs. No movement during recoil. 2" 5-shot groups with bonded ammo and un-magnified optic. Slap a scope and bipod on this baby and it'd be a deadly DMR. You've scored another Grail Masterpiece, Mr. Sullivan, I ain't changing a damn thing on it. It's the best AR I own.*

The barrel is free floated under a long carbon fiber handguard. For practical accuracy, the iron sight radius is maximized. With the improvements in optics, iron sights become secondary in general use but remain vital in certain circumstances. For example, a fogged-up optic taken outside becomes instantly useless. Being able to remove a QD mount and switch to irons saves the day. The original Grain used a fixed front sight—fine for use with red dots, but an annoyance with low power variable scopes. The folding iron sight set is same-plane dual-aperture Troy, strong and designed to eliminate the glare that accompanies the Mil-Spec AR-type rifle rear sight.

A good trigger is part of the solution, so a 4.5lb LaRue Tactical MBT is used. The pull weight is high enough to be safe with gloves on and low enough for accurate shooting.

An enlarged trigger guard of Sully's own design allows for tactical and winter gloves.

The forend deserves special note: 3mm thick, with an endcap to keep carbon fiber from splitting, it's both rigid enough and reasonably light. Large cooling holes alternate with smaller threaded opening for mounting rails at the top, bottom and both sides. Unlike aluminum, carbon fiber doesn't transmit barrel heat readily to the support hand, nor does it vibrate during the shot when placed on a support. 3.5-inch Picatinny rail segments come preinstalled on the sides and the bottom, with an 8.5-inch rail on top. That places the front sight and any other accessories—bipod, light, laser—near the muzzle where they belong. A metal mounting ring and base keep the forend rigidly aligned with the barrel, even under pressure. Additional rail segments can be added for a vertical foregrip, but the textured spot on the magwell offers an alternative hold.

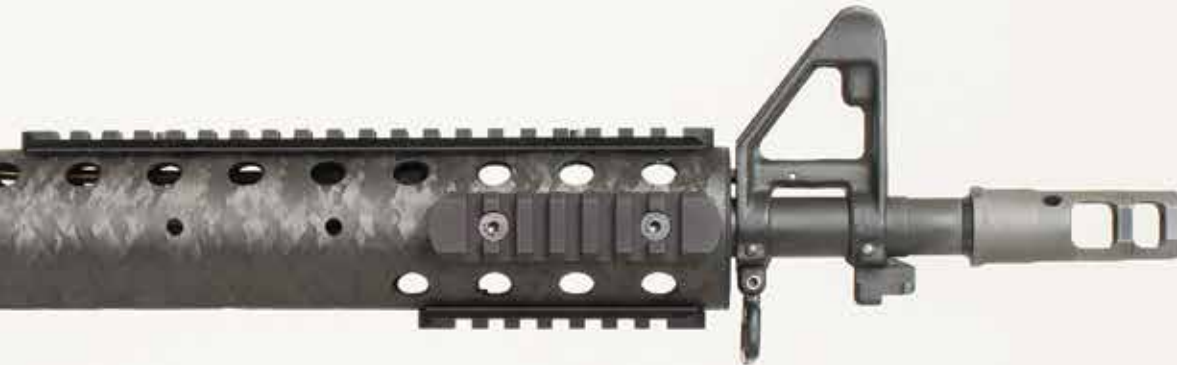
The rifle weighs approx. 7.33 pounds with an empty magazine. It feels much lighter due to the balance being further back than usual. A relatively light barrel and unusually solid buttstock allow one-handed control of the weapon—a big help when the support hand is needed for opening doors, signing to others, or in case of an injury. That, combined with the short length of pull, adds up to quick pointing and easy use, even by smaller-statured shooters. Usually muzzle-light rifles pay for it with slower shot-to-shot slit times, but the Grail Rifle excels even there. At the range, Sully's demo firing sounded like a machine gun, admittedly a relatively slow one. When testing muzzle devices, he picked out the suppressor-compatible two-chamber SureFire brake on the basis of observed effectiveness. (It happened to be the brake picked by Rich Lucibella for his

The original 2009 Grail Rifle with the fixed front sight and Mil-Spec sling swivels.





Who would you ask to design your AR-type rifle: a SWAT leader and trainer or a professional gunsmith and armorer? If you picked “both,” welcome to SLR15!



personal Grail and then it proved itself again in side-by-side comparison tests.)

The rifle is loud, but any rifle firing on a SWAT mission indoors will be loud due to sound-reflecting surfaces. A sound suppressor would fix that issue without reducing the brake effectiveness. The noise energy would be mostly converted to heat and the brake would act as an expendable blast baffle. Firing from a sandbag at 100 yards and letting the gun forend lift as it may, I could still spot my own hits through the 6-power Trijicon VCOG® riflescope. Muzzle rise was even less when we shot standing with the support hand controlling the forend.

The rifle is equipped with a standard non-adjustable mid-length gas system. Heavier buffers are used to tune for suppressed use. SLR15 also offers a Gas Diverter Vent to replace the usual forward assist plunger. It channels blowback away from the face for right-handed shooters. Sully recommends OSS® suppressors to avoid gas blowback at the source.

The SLR15 Grail Rifle continues to evolve, but it is already a quick, reliable and accurate design. The American flag printed on the side of the bolt is well-merited—it's one of the most logical developments of the AR-type rifle I've encountered. For the best effectiveness with it, I would recommend attending Defensive Edge carbine courses. For more information, check out [slr15.com](http://slr15.com) and [thedefensivedge.com](http://thedefensivedge.com). SADJ



# MSPO 2021—New National Pavilions

*According to the Americans and the British, this year's MSPO promises to be an outstanding show. Preparations for the upcoming 29th International Defence Industry Exhibition are underway. Almost 150 exhibitors from all over the world have already registered.*

This year's MSPO exhibition will feature a novelty—the "National Pavilions" as the new unveiling of what you may already be familiar with, i.e., Lead Nation Exhibition.

The United States' pavilion, featuring prominent industry companies, is already an exciting component of MSPO. The USA pavilion includes a plethora of companies, including: Bell, CAMSS Shelters, Cubic, General Atomics, Honeywell, L3Harris, Lockheed Martin Corporation, MAXAR, Milliken, Motorola, Northrop Grumman, PEI Genesis and Raytheon Technologies.

The British pavilion enjoys strong representation with Concurrent Technologies Plc, Enterprise Control Systems Ltd, FT Technologies Limited, G&H Aerospace & Defense, OTM Servo Mechanism Ltd, Spectra Group UK Limited, SteelRock Technologies Limited, Stormproofings Ltd, Templar Executives Ltd and Total EMC Products Limited in the lineup.

German companies are also announcing their presence: Fischer Panda GmbH, Glenair GmbH, HAIX Group, HENSOLDT HOLDING Germany GmbH, ITT Cannon GmbH, KRAUSS - MAFFEI WEGMANN GmbH & Co. KG and STEIN-

BACH AG, to name just a few.

Representatives of Norway (including Norwegian Defence and Security Industries Association, Kongsberg Défense and Aerospace AS, NAMMO AS), as well as the Ukraine (UKROBORONPROM, MOTORSICH) and Italy (Leonardo) have already confirmed their participation.

The expo strategic partner, i.e., Polish Armaments Group, also marks its presence and a display of the latest technologies developed for the trade show by the Group's companies.

As is tradition, the offerings of the global defence industry will be complemented and enhanced by the Armed Forces Exhibition; held under the banner of "Endure-Control-Defeat."

Although preparations for MSPO 2021 have been ongoing for several months, the Polish government's decision on June 6, 2021 to put the exhibition industry back on track gave extra fuel to the preparations.

The 2020 MSPO exhibition was organized with strict observance of sanitary rules and regulations and brought together 185 companies from 15 countries. 2020 MSPO was a showcase for the elite of rocket weapons manufacturers, from the U.S. with Raytheon and Lockheed Martin to the British with MBDA. In its 3 days, the exhibition attracted several thousand visitors despite the pandemic.

The upcoming 2021 MSPO show will be held from September 7-10. Mr. Andrzej Duda, President of the Republic of Poland, has given his support to the MSPO 2021 exhibition. MSPO hopes he will be able to visit the exhibition this year (he has visited MSPO many times in past years). **SADJ**

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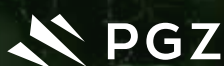
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# Explosives, Propel

## A Chronological Journey (Part 1)

By Paul Evancoe

**T**his article will run in 3 parts over 3 issues of *Small Arms Defense Journal (SADJ)*. In this part (Part 1), we will connect the dots

of the developmental chronology of explosives and propellants along with their entwined relationship to one another. In Part 2, we'll exam-

ine the developmental chronology of explosives used for ignition and their relationship to firearms firing mechanisms that advanced as a direct result.



Rendering depicts the use of Greek fire in the 673 AD sea battle between the Byzantines of Constantinople and the invading Saracen fleet. Greek fire was used as an incendiary propellant and acted as both an incendiary and chemical weapon. It reportedly burned on the surface of the sea.



# lants and Ignition

In Part 3, we'll explore the chronological development of modern primer caps and metallic cartridges.

There are three types of explosives: mechanical, atomic and chemical. For example, a steam boiler exploding from overpressure is a mechanical explosion. An atomic explosion is best exemplified by the detonation

of a nuclear bomb and its ensuing mushroom cloud. Both mechanical and atomic explosives are irrelevant to this article and will not be further addressed.

A chemical explosion, along with its slower-burning propellant version, is generated by the near instantaneous combustion of a chemical compound

that exerts sudden pressure on its surroundings. While explosives and propellants generally involve different formulations, they both create a rapid release of expanding gas. Therefore, it is the velocity of combustion (rate of detonation) that determines the difference between high explosives and low explosives



used for propellants.

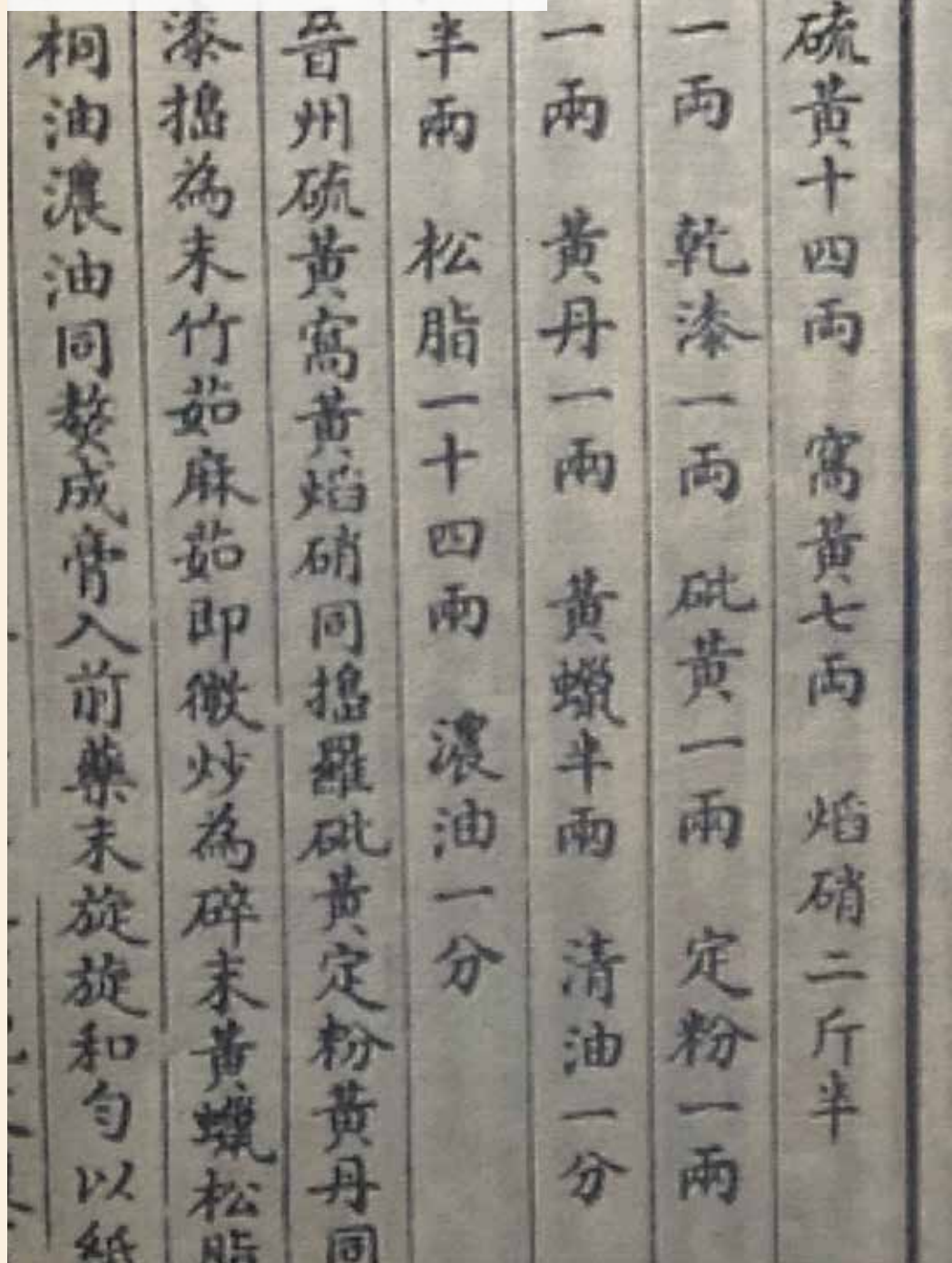
Low explosives compounds possess a (burn) rate of decomposition that proceeds through the material at less than the speed of sound (1,100 feet per second). As such, they don't detonate, they deflagrate, and that's what makes them suitable for use as propellants. Also included in this group are petroleum products such as propane, gasoline and gun powder—which includes black powder, smokeless powder, light pyrotechnics, such as fireworks and flares (even old style self-igniting match heads). However, some of these low explosives, like black powder or liquified propane (if configured as a fuel-air explosive [FAE]), can replace high explosives for peculiar applications.

High explosives (HE) are explosive compounds that detonate at supersonic velocity—meaning that the explosive shock front passes through the material as it is consumed at supersonic or hypersonic speed (depending upon the explosive compound). High explosives detonate with explosive velocities that can range from 9,800 up to 29,500 feet per second. For instance, TNT has a detonation (burn) rate of approximately 19,000 feet per second; detonating cord clocks in at about 22,000 feet per second and C-4 detonates around 29,000 feet per second which is about 26 times faster than the speed of sound.

Explosives are subsequently divided into two classes differentiated by sensitivity: primary explosive and secondary explosive. A primary explosive is sensitive to friction, compression, shock or heat. Examples of primary explosives include mercury fulminate or lead azide. A secondary explosive is less sensitive than a primary explosive and requires substantially more energy to be initiated. Because they are less sensitive, they are usable in a wider variety of applications and are safer to handle and store. Secondary explosives are used in larger quantities in an explosive train and are usually initiated by a smaller quantity of a primary explosive. Examples of secondary explosives include TNT and RDX. More on this as we explore the chronological development of energetic chemistry (explosives).

The first recorded use of explosives was by the Byzantine defenders of

The Chinese are generally credited as the inventor of black powder around the 10th century. Pictured is the first known written recipe for black powder, taken from the Wujing Zongyao manuscript (circ.1040-1044).



Constantinople against the invading Saracen fleet in 673 AD. The Byzantines used an incendiary propellant that reportedly also generated acrid smoke. Called "Greek fire," it acted as both an incendiary and a chemical weapon and reportedly burned on the surface of the sea. Its exact formula remains a mystery, but it's thought to have been a powdered compound made out of a mixture

of sulfur, naphtha, pine resin, calcium phosphide and quicklime (don't try this at home). Historical accounts describe the Byzantines using nozzles to project (spray) Greek fire (much like a modern flamethrower) onto enemy ships and troops. They also effectively launched it in containers from catapults and packaged it into small hand thrown incendiary-style grenades. Greek fire marked the begin-

# 火藥法

散子木二百五十條 救火大桶二  
鐵鈎十八箇 大木樞二箇 界扎索一十條  
水灑二箇 拒馬二 麻搭四具 小水桶二隻  
唧筒四箇 土布袋一十五條 界緣索一十條  
鐵三具 鐵一領 鑽三具 火索一十條  
右隨砲預備用以蓋覆及防火箭

dry compound burned energetically. Factually, black powder is the oldest form of chemical explosive. It's age-old chemical formula—consisting of 75% potassium nitrate, 15% charcoal and 10% sulfur—is still used today to make black powder. It still serves as a low velocity propellant for many modern munitions, as well as a means to initiate (ignite) secondary explosive charges.

The development and use of the first rifles are generally credited to 13<sup>th</sup> century Mediterranean Muslims. These rudimentary muzzle loading rifles used black powder as a propellant and a small piece of smoldering rope to ignite it. Small stone ball projectiles were loaded through crude muzzle-loaded tubes made from wooden slats that were wrapped with rope to strengthen them against high pressure rupture. Since skilled hoopers (the makers of wooden barrels) were the only craftsmen who possessed the knowhow to make them, the tubes were called barrels and the name has stuck to this day. It's probably good that plumbers weren't the first barrel makers, or they might have been called "pipes." Regardless, the application of black powder as a propellant was married to projectile-firing firearms and the further development of both quickly spread across the European Continent.

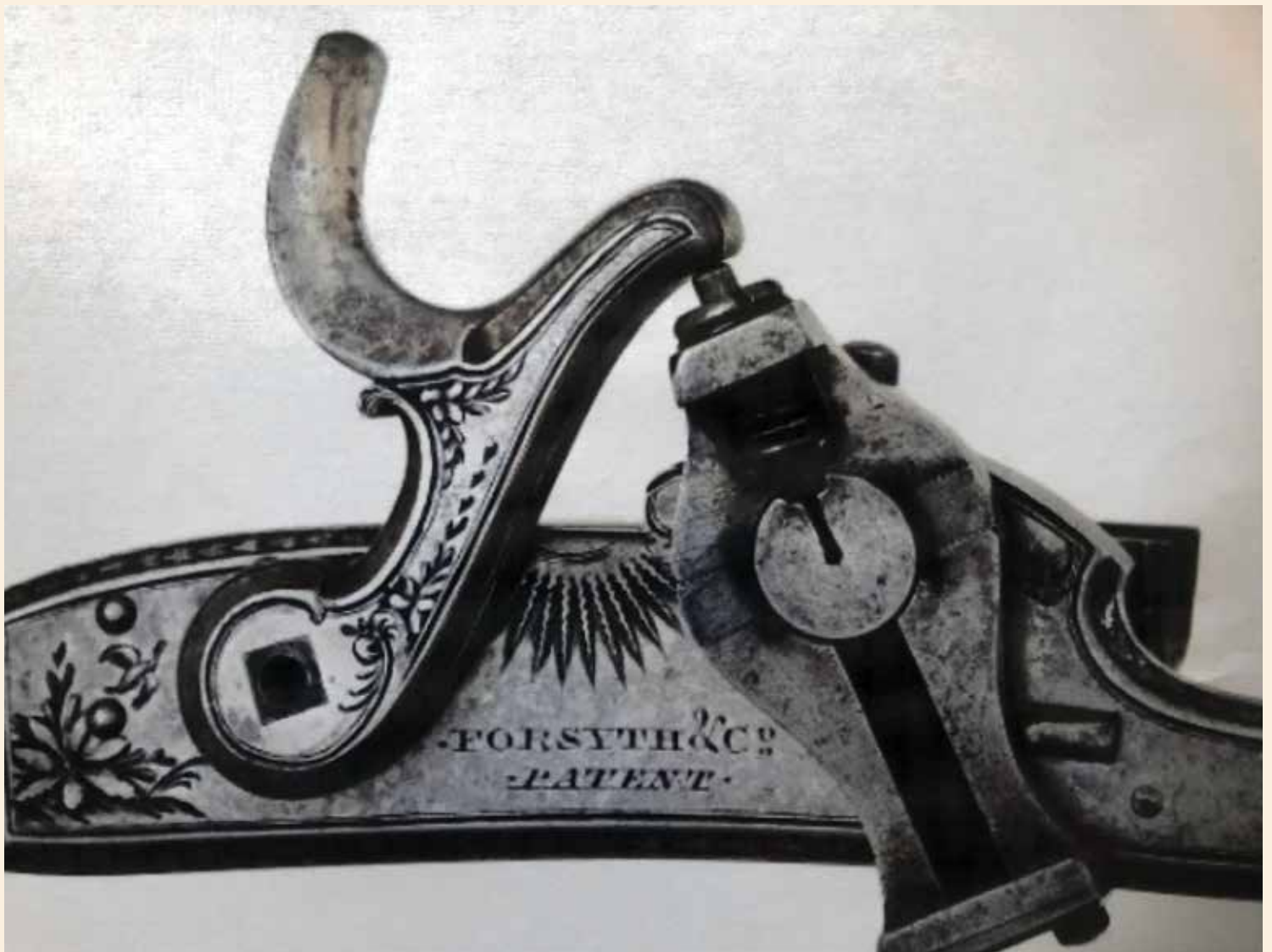
By the early 17<sup>th</sup> century, Swedish King Gustavus Adolphus established the first true field artillery unit. These cannons consisted of heavy cast iron firing tubes (barrels) mounted on wheeled frames allowing their mobility. These unsophisticated artillery pieces used black powder as propellant and fired rounded stones and crude iron balls as projectiles. Cast iron is a brittle metal so the drawback was that the cannons had a tendency to unpredictably explode when fired, making them equally precarious for both the sending and receiving side of the battle line. Nonetheless, this seemingly small step by King Gustavus established artillery and black powder propellant as an important component of battlefield armamentarium. In turn, this institutionalized the use of combined arms and insured Sweden's dominance as a Baltic military force for the next two centuries. It also laid the foundation for a flourishing Swedish arms industry that

ning of the warfare shift away from full body-contact battle using edged weapons, to the tactical use of stand-off weaponry capable of inflicting mass casualties.

Black powder followed as the next game changer, but surprisingly, its potential was not realized for several centuries. The Chinese are generally credited as its inventor around the 10<sup>th</sup> century, because they were first

known to use it in fireworks. Historical specifics and documented timelines are vague, but it's not a leap to imagine that the Chinese first invented the black powder compound well prior to the 10<sup>th</sup> century for use as medicine. Its likely purpose might have been as a topical medication to clot bleeding sword wounds or to prevent infection. Then one glorious day, someone accidentally discovered that the





Patented in 1807, John Forsyth's invention of the "scent bottle" fulminate-primed firing mechanism eliminated the puff of smoke from the flash pan and shortened the ignition sequence from trigger pull to main propellant discharge. He encased his fulminate primer compound in a small metal tube (the forerunner of today's primer cup), which was ignited by the hammer strike.

continues to this day.

As metallurgical technology advanced, smoothbore gun barrels were first made from brass, then bronze and then iron. Steel rifle and cannon barrels didn't debut until the late 17<sup>th</sup> century, because the manufacturing processes necessary to make steel on a large scale hadn't been perfected. Small quantities of steel had been smelted for thousands of years using charcoal-fired bloomery (chimney-like) furnaces constructed out of clay or brick. Archaeological evidence confirms that bloomeries were used in China as early as 800 BC.

However, steel wasn't used in firearms construction until the introduction of the blast furnace in the 17<sup>th</sup> century, which could consistently produce a high volume of quality crucible steel.

The American Revolutionary War

(1775–1783) was largely fought by both sides using black powder as the propellant for flintlock-fired muzzle loaded smoothbore muskets and pistols. Both sides also employed muzzle loaded artillery cannons. Interestingly, this new warfighting technology brought fire and maneuver to new levels by introducing the employment of designated marksmen and small unit tactics supported by mobile field artillery.

The pioneering discovery of fulminates was made in 1799 by British chemist of eminence, Edward Charles Howard, the youngest brother of Bernard Howard, the 12<sup>th</sup> Duke of Norfolk. Edward Howard was a self-trained chemist and inventor who was credited with developing mercury fulminate. He was also one of the first scientists to analyze the chemical composition of meteorites and realize, based

upon comparative chemical analysis, they were not something formed on Earth. He additionally designed and patented the vacuum evaporator and other related accessories that directly improved sugar production.

Back to fulminates. Fulminates are chemical compounds which compose friction-sensitive and pressure-sensitive explosives. This means fulminate explosives will easily detonate from the friction created by compression and shock. Fulminates can be created from metals, such as silver and mercury, dissolved in nitric acid and reacted with ethanol. The most recognized is mercury fulminate, which was later used by Alfred Nobel as the initiating explosive in his invention of the blasting cap. Edward Howard's discovery was a landmark in gunpowder ignition technology directly leading to the

*It has been long said that accident is the mother of invention. Like many other brilliant discoveries, Schoenbein's discovery of nitrocellulose (also called guncotton) occurred when he accidentally spilled an acid mixture on a cotton apron and the apron exploded.*

percussion cap (and later the primer cap, used in modern metallic-cased cartridge ammunition).

The percussion cap was made possible using Howard's earlier discovery of fulminates and was patented in 1807 by Scottish Reverend Alexander John Forsyth. Besides preaching the Sunday gospel, the good Reverend was an avid sportsman and bird hunter who became frustrated because his flintlock shotgun would startle the birds from the flash and puff of smoke given off by the flash pan as it ignited. Additionally, the resultant time delay for the flash pan's primer charge to burn through the torch (flash) hole and ignite the gun's main charge provided further frustration. According to Forsyth, this [flash and time delay] "gave the birds sufficient warning to escape" [the arrival of the shot string].

Forsyth modified his flintlock shotgun by removing all the flint-spark generating apparatus and replacing it with his own percussion system. Forsyth's crude percussion lock system operated in a nearly identical fashion to the flintlock, but he used a fulminating primer which he made from a mix of fulminate of mercury, chlorate of potash, sulfur and charcoal. Instead of sparks from a flint, it was ignited by concussion from the hammer hitting against the fulminate-filled pan (reshaped to more of open top cup-like container). His invention of the fulminate-primed firing mechanism eliminated the initial puff of smoke from the flash pan, as well as shortened the interval between the trigger pull and ignition of the shotgun's main propellant charge. Forsyth patented his "scent bottle" ignition system in 1807 and bird hunting was better forever after.

The precursor to the modern percussion cap system was not developed until years later after Forsyth's patents expired. British gunsmith, Joseph Manton, invented the predecessor to the modern percussion cap

in 1814 and a replacement for Forsyth's scent-bottle lock which Manton named the tube (or pill) lock.

Instead of putting fulminate in an open top pan, Manton invented single-use fulminate pellets (he called "pills") for use as the primer which he enclosed inside a small, thin-walled copper tube. Manton sharpened the gun's hammer (into a crude hammer spur-style firing pin) so when it fell, it crushed the tube/pellet, which caused the pressure sensitive fulminate it contained to detonate. This was much more reliable than Forsyth's open scent bottle lock design and it gained huge popularity during the 1811-1820 Regency period among sportsmen.

Coinciding with Napoleon's early conquests, the European Regency period is most known for its achievements in the fine arts, architectural elegance and pomp and circumstance, but it also saw numerous advancements in firearms. This era encompassed a time of great social, political and economic change. Manton's "pill" ignition advancement was quickly eclipsed by the percussion cap, which was immediately adopted by the British, French, Russian and American armies as a replacement for the flintlock. This form of ignition was further developed (not invented) in 1822 by the English-born American artist and scientist, Joshua Shaw, as a small copper cup filled with fulminates—and the primer cap was born.

Civil Wars (European and U.S.) of the 19<sup>th</sup> century and World Wars I and II of the 20<sup>th</sup> century further drove dramatic improvements in explosives, propellants and ammunition. The era of modern propellants began in 1845 when German chemist, Christian Schoenbein, discovered nitrocellulose, a substance that burns completely and leaves no solid residues. Black powder, by comparison, produces over half its weight as solid residue along with extremely corrosive sulfuric acid as a byproduct of its combustion. It has been long said that

accident is the mother of invention. Like many other brilliant discoveries, Schoenbein's discovery of nitrocellulose (also called guncotton) occurred when he accidentally spilled an acid mixture on a cotton apron and the apron exploded. And thus, guncotton was invented.

Although Alfred Nobel is often credited with inventing nitroglycerine, he was not its inventor. It was Italian chemist Ascanio Sobrero, who in 1846 discovered a highly volatile chemical explosive he named "nitroglycerin." Nitroglycerin is a high explosive mixture of nitric acid, sulphuric acid, and glycerol. Nitroglycerin is an extremely powerful, as well as unstable, and easily detonated (sensitive) high explosive which made it dangerous to handle, store and use. Sobrero, himself, thought nitroglycerin was too volatile to be useful and was wary of continuing its further development.

In 1863, TNT, or Trinitrotoluene, was invented by German chemist Joseph Wilbrand whose goal was to develop a safe-to-use insensitive high explosive. Insensitive, because TNT won't detonate from exposure to fire or friction pressure. TNT requires a separate explosive charge to initiate its detonation and it's a high explosive because it has a high rate (velocity) of detonation. High explosives cannot be used as a propellant because their rate of detonation is too fast; they easily cut steel and/or shatter anything within contact range. Another attribute of TNT is that it is non-hydroscopic, meaning that it doesn't soak up water and won't degrade in high moisture environments. TNT can therefore be used in water and stored in wet environments. This made TNT the ideal explosive for military demolition applications and projectile warheads. Even so, TNT didn't proliferate in military use until the 20<sup>th</sup> century.

In 1865, during the last year of the American Civil War, Swedish chem-

*The Byzantines used an incendiary propellant that reportedly also generated acrid smoke. Called “Greek fire,” it acted as both an incendiary and a chemical weapon and reportedly burned on the surface of the sea.*

ist, engineer, inventor, businessman and philanthropist, Alfred Nobel, patented the blasting cap. Nobel invented the blasting cap to provide a safer and more reliable means of detonating nitroglycerin.

An important problem in the industrial and military application of nitroglycerine was finding a safe and reliable method for firing the explosive. Nitroglycerine was so sensitive it could easily detonate from mishandling or from being stored in a less than ideally cool environment.

Nobel discovered that it was possible to reliably fire nitroglycerin using an initiating explosion. He began his blasting cap invention by using a small charge of gunpowder contained in a small metal cartridge but soon replaced that with a small thin-walled metal tube about the diameter of a modern ballpoint pen that was closed on one end. Nobel loaded the tube about half full of Howard’s mercury fulminate mixed with gunpowder and potassium nitrate. The rest of the tube (about the top 1/3) was left empty so a fuse could be inserted into the open end. The tube was then crimped onto the fuse to prevent it from accidentally coming loose.

Nobel’s blasting cap provided a small initiating explosive that detonated the nitroglycerin main charge which, for the first time, made nitroglycerine useful as a blasting explosive. As later described by de Mosen-thal (1899), “the full importance of Nobel’s discovery of firing an explosive by a separate initial explosion instead of a flame or flash has been considered the greatest invention since the discovery of gunpowder, and it makes Nobel not only the creator of the nitroglycerin industry but also the father of the modern high explosive industry.”

But Nobel wasn’t finished. In 1867, Nobel went on to invent and patent dynamite as a means to desensitize nitroglycerine. Dynamite is a high explosive made of nitroglycerin, sor-

bents (such as powdered seashells or clay) and stabilizers. This mixture of sorbents and stabilizers desensitizes the nitroglycerin, making dynamite far safer than nitroglycerine to store, transport/handle and use. Dynamite also gained rapid worldwide use as a safer and more powerful alternative to black powder for mining and other earth-moving uses.

In 1881, French physicist Paul Vieille and French chemist Marcellin Berthelot collaborated in groundbreaking research into the physics of explosively-generated shock waves. This led to a completely new understanding of explosive shock wave propagation and how to generate and shape it, as well as control its velocity through its chemistry (compound).

Armed with this knowledge, Vieille continued his research throughout 1882-1884 to find a clean burning smokeless replacement propellant for black powder. Black powder was a dirty-burning corrosive residue explosive. Plus, it gave off high volumes of smoke that marked the position of its user and obscured the battlefield during the heat of battle. Vieille aimed to solve the problem by harnessing Christian Schoenbein’s powerful but unstable nitrocellulose (guncotton) and use it as a propellant.

Cellulose is a naturally-occurring polymer obtained from wood pulp or the short fibers (linters) that adhere to cotton seeds. Vieille first nitrated the cellulose to make it explosive, then used solvents and a colloidizing action (the chemical phenomena of atomic collisions between different elements that produce a desired outcome/effect) with an ether-alcohol mixture. The result was an explosive gelatinous mass which he subsequently molded into small explosive cakes. The cakes were then dried and powdered. And nitrocellulose propellant was born. Roughly three times as powerful as black powder for the same weight, it left virtually no resi-

dues of combustion and became the first of a series of modern smokeless high explosives. In 1885, Vieille’s nitrocellulose explosive was designated “Poudre B” and accepted as the service-wide ammunition propellant for the French army.

Vieille made further contributions in the study of shock wave propagation and pressures, and on the chemical stability of nitrocellulose. He soon became director of the “Laboratoire Central des Poudres et Salpêtres” in Paris, where his research had taken place. His invention of nitrocellulose was later applied not only to small arms ammunition but also to the full range of artillery propellants and was widely accepted by all the major military powers worldwide.

In 1887, Nobel, while living in Paris, came up with another world-class winner when he invented a dense smokeless propellant called “ballistite”—which years later morphed into “ball powder.” Nobel made ballistite from a mix of two high explosives, nitroglycerine (invented by Sobrero in 1846) and nitrocellulose (invented by Vieille in 1885).

Nobel’s intention was to sell his ballistite patent rights to the French government but they declined, largely because they had just adopted Paul Vieille’s Poudre B a few years earlier (circ. 1885). Nobel was an inventor, but he was also a prudent businessman. After being turned down by the French government, Nobel went shopping for a customer and subsequently licensed the rights to the Italian government who, in 1889, signed a contract to obtain 300,000 kilograms (661,387 pounds) of Nobel’s ballistite. Nobel opened a production factory at Avigliana, a municipality in the City of Turin, located in Italy’s north central Piedmont region.

The Italian Army immediately replaced their old M1870 and M1870/87 service rifles, which fired black powder-loaded cartridges, with a new model, the M1890 Vetterli, which



*World War I (1914-1918) and World War II (1939-1945) drove both explosives and propellants development to new levels. For example, C-2, C-3 and C-4 plastic explosives were developed, as was Composition B, RDX and PETEN.*

used a cartridge loaded with Nobel's smokeless ballistite. This seemingly small business decision made by Nobel led to his public character assassination in France, because at the time, Italy and France were both competing great powers. Even though Nobel offered his ballistite to France first and was turned down, his business deal with Italy outraged the French government and the press fueled additional public negativism. French newspapers accused Nobel of industrial espionage and "high treason against France."

As a political punishment, Nobel was refused permission to conduct any research, or to manufacture explosives on French soil. Nobel was now without a home, so in 1891 he moved to San Remo, Italy where he spent the last five years of his life. Interestingly, ballistite is still manufactured today and used as a solid fuel rocket propellant.

What about the Nobel Prize? In Nobel's will, he bequeathed his sizeable fortune to establishing the Nobel Prize Institution in Norway—but why Norway? Nobel held 355 different patents (dynamite was his most famous). He owned Bofors, which he had profitably realigned from primarily producing iron and steel to a major manufacturer of cannon and other armaments. Some believe Nobel created the Nobel Prize out of a sense of guilt from making a fortune manufacturing and selling armaments and explosives that resulted in death and destruction. Others believe he did it as a memorial to his deceased brother who was accidentally killed as a result of Nobel's explosives research. And why Norway? Nobel was a Swede who spent most of his life in France and Italy. Locating the Nobel Prize Institution in Norway remains a conundrum, but there might be a clue. Nobel's girlfriend was Norwegian—enough said.

Taking a few steps backward to 1889, a government committee in Great Britain (also in great power competition with France and Italy) called the

"Explosives Committee" was chaired by explosives specialist Sir Frederick Abel. The committee's purpose was to monitor foreign developments in explosives (read between the lines as "collect intelligence"). Chairman Abel and committeeman, chemist Sir James Dewar (no relation to the Scotch whisky founder), jointly patented a modified form of Nobel's ballistite. Their formula consisted of 58% nitroglycerin by weight, 37% guncotton and 5% petroleum jelly. Using acetone as a solvent to soften the mixture, the compound was extruded as small diameter spaghetti-like rods and was initially called "cord powder," but it was soon abbreviated to cordite. Cordite has a uniquely distinguishable odor when it's burned, making its use easily identifiable.

Nobel brought a lawsuit against the two for patent infringement but eventually lost in a protracted court battle. This was no surprise in view of the great power competition between Britain, France, Italy and Germany, not to mention the potential money involved. Not surprisingly, cordite was later adopted by the British army as the standard explosive propellant and general replacement for black powder.

World War I (1914-1918) and World War II (1939-1945) drove both explosives and propellants development to new levels. For example, C-2, C-3 and C-4 plastic explosives were developed, as was Composition B, RDX and PETEN. Binary explosives made their debut on the battlefield as well but were too expensive, as well as too high velocity for civilian mining applications. As such, dynamite remained the constant for mining and rock blasting until 1955, when the use of modern high explosives such as ammonium nitrate-fuel oil mixtures (ANFO) and ammonium nitrate-base water gels accounted for seventy percent of the explosive market for mining and other earth-moving applications.

Clearly, the development of explosives and propellants occurred over many centuries and they remain entwined to this day. Beginning with crude cannon and muzzle loading long guns, black powder was the standard propellant for guns. But muzzle loading was a single shot, slow-firing endeavor requiring the right combination of several components. The shooter had to measure a specific charge of black powder and drop it into the gun's bore from the muzzle end of the gun, then insert some form of wadding, either atop the powder or around the projectile, to create a gas seal. Then, the projectile was rammed down the bore against the powder charge with enough force to put it in contact with the wadding atop the powder. This also eliminated any air space. Next, the flash pan ignition source had to be readied.

During the American Revolutionary War, this component loading cycle was called a "round." A "round" simply meant that a soldier had enough of all the components he needed to fire his weapon one time. For example, one might carry enough of everything (black powder, patch, lead ball) to fire, say, 20 rounds. When the troops were ordered to carry 20 rounds, that meant they had to carry enough of everything necessary to fire 20 shots, and yes—that's where the term "round" came from. The term "round" had nothing to do with the shape of the round lead (mini-ball) projectile. Today, we refer to a loaded cartridge as a round and thusly, our AR-15s use 30-round [capacity] magazines and we buy 50-round boxes of ammunition. **SADJ**

\* \* \*

*In Part 2 of this article, which will follow in a subsequent SADJ issue, we will explore the developmental chronology of ignition sources, along with the firearms firing components they made possible. Stay tuned.*

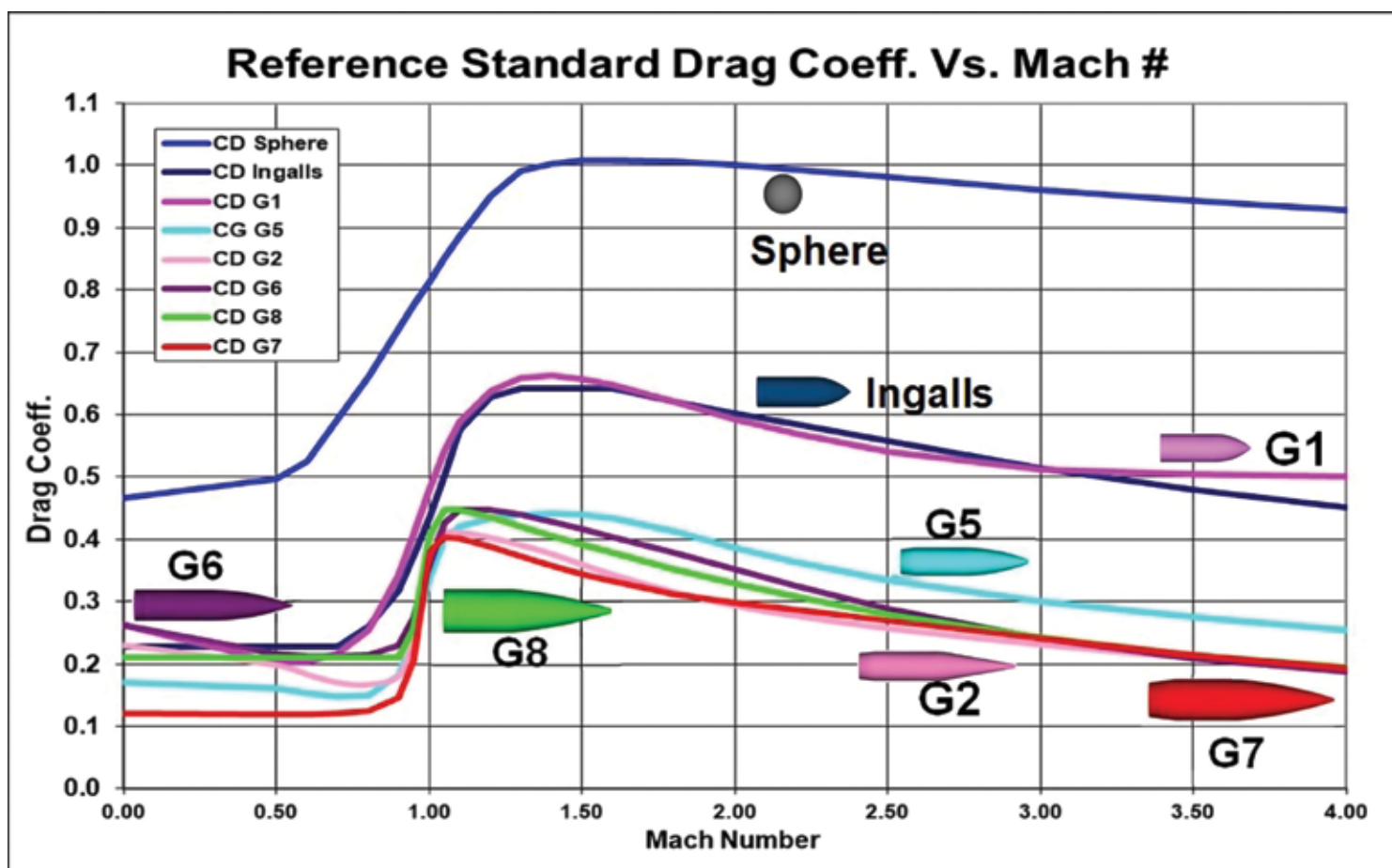


Figure 1: Drag Coeff. vs. Mach Number for Various Siacci Reference Projectiles

# Exterior Ballistics and the Projectile Flight to the Target

By Jeff Siewert

**E**xterior ballistics is the science of computing the flight path of a bullet from launch to the target. Sir Isaac Newton's equations of motion, first published in *Principia* in 1687, with terms added for a complete aerodynamic model, form the basis of the computations used by today's state-of-the-art trajectory programs.

The invention of the ballistic pendulum by Benjamin Robins in 1742 started to give scientists an idea of the magnitude of the effect air resistance has on bullet flight. Bullets were fired at a wood catch block and the height of the pendulum swing in response to the bullet impact was used to estimate the striking velocity of the projectile. 19<sup>th</sup> century work by George Cayley on heavier-than-air craft identified the fundamental forces of flight: lift, thrust, drag and weight. This work formed the foun-

dation of modern trajectory codes.

In 1880, Francesco Siacci published his *Ballistica* which used "shortcuts" in a technique now commonly referred to as the Siacci equations. These equations use a factor commonly referred to as ballistic coefficient, or "BC" for short, to describe how well the bullet cuts through the air, with gyroscopic stability assumed. Figure 1 shows the drag coefficients of the various  $G_N$  coefficients as a function of Mach number. Each subscript refers to a different "standard" bullet shape.

The "G" of the  $G_N$  functions stands for "Gâvres," a ballistic test range on the Atlantic coast of France—the site of extensive trajectory ballistic testing conducted by the French Government in the 19<sup>th</sup> century.

The ballistic coefficient is defined by McCoy in his "Modern Exterior Ballistics" as:

$$C_i = \left( \frac{m}{i_j d^2} \right) \left( \frac{\rho_0}{\rho} \right)$$

#### Equation 1: Ballistic Coefficient Definition

##### Where:

$C_i$  = is the ballistic coefficient relative to the "j" drag function

$m$  = projectile mass, lb.

$i_j$  = Form Factor, relative to the "j" drag function

$j$  = the reference drag function (Ingalls, 1, 2, 5, 6, 7, 8 or Sphere in the tables)

$d$  = projectile reference diameter, inches

$\rho_0$  = standard sea-level atmosphere density, (0.075126 lbm/ft<sup>3</sup>)

$\rho$  = local air density, lb/ft<sup>3</sup>

The Siacci method uses a list of tables containing the following Siacci functions:

- Space Function,  $S(V)$
- Time of Flight Function,  $T(V)$
- Inclination Function,  $I(V)$
- Altitude Function,  $A(V)$

Tables of each of these functions for each of eight projectile shapes shown in *Figure 1* are used to compute the bullet flight path. If a BC is specified for a bullet, that call-out should also specify which Siacci reference projectile is used as a basis for the ballistic coefficient. Many closed form trajectory codes use G1 as their "reference," while others, designed specifically for long range shooting, more commonly use the G7 function. The reason is projectiles designed for long range shooting are closer in exterior shape to the G7 projectile than they are to the G1, making the trajectory computations deviate less from the actual trajectory. *Figure 1* shows the drag coefficient vs. Mach number for the standard reference Siacci projectiles, along with a miniature graphic of the projectile geometry from McCoy's book. The drag functions are color coded with a corresponding colored image of the bullet shape. Most of the "freeware" trajectory codes available for smart phones use the Siacci trajectory computational approach, or modifications thereof. The notable exceptions to this are the Hornady® 4DOF® and Lapua 6DOF trajectory codes.

Regarding projectile "stability," Mr. George Greenhill, a mathematics professor at the Royal Military Academy in Woolwich, England, developed a formula in 1879 to **estimate** the twist required for gyroscopic stability, without regard for projectile shape, mass distribution or air density—all of which affect gyroscopic stability. That formula is shown in *Equation 2*:

$$Twist = \frac{CD^2}{L} \times \sqrt{\frac{SG}{10.9}}$$

#### Equation 2: Greenhill Equation

##### Where:

$C$  = 150 unless velocity > 2800 FPS, where 180 should be used

$D$  = Projectile Diameter in Inches

$SG$  = Specific Gravity of Projectile Material (1.0 = Water, 10.9 = Lead Alloy)

The Greenhill equation does not take into account effect of the mass distribution within the projectile on either

the spin momentum caused by the bullet rotation, nor the effect of projectile shape on aerodynamic moment coefficients. Thus, the Greenhill equation can only provide inaccurate estimates of the twist required to provide gyroscopic stability for a projectile.

There are actually two types of stability to be addressed for rifles and handguns: gyroscopic stability and dynamic stability. The gyroscopic stability factor indicates whether the projectile has sufficient spin to keep the bullet generally pointed nose forward in flight. *Equation 3* lists the equation for gyroscopic stability.

$$S_{go} = \frac{(2)(I_x^2)(p^2)}{(\pi)(\rho_o)(I_y)(C_{m\alpha})(d^3)(V_m^2)} :$$

#### Equation 3: Gyroscopic Stability Equation

##### Where:

$S_{go}$  = Gyroscopic Stability Factor at the Muzzle

$I_x$  = Projectile Polar Moment of Inertia

$p$  = Projectile Spin Rate, Radians per Second

$\rho_o$  = Air Density at Gun Muzzle

$I_y$  = Projectile Transverse Moment of Inertia

$C_{m\alpha}$  = Projectile Pitching Moment Coefficient Derivative

$d$  = Projectile Reference Diameter

$V_m$  = Muzzle Velocity

A projectile is considered to be gyroscopically stable if  $S_g$  is greater than 1.0. In practice, some stability margin is desirable, so most spin stabilized projectiles are launched with a gyroscopic stability factor of 1.40 or higher to address the adverse effect of cold air temperatures on air density and gyroscopic stability.

Dynamic stability is the other type of stability of interest to those computing trajectories. A bullet possesses dynamic stability if any average yaw or pitch angle decreases as the projectile flies downrange. The equation for dynamic stability is shown in *Equation 4*.

$$S_d = \frac{2(C_{N\alpha} - C_X(k_1^{-2}/2)C_{npa}}{(C_{n\alpha} - C_X - k_2^{-2})C_{mq} + (k_1^{-2}/2)C_{lp}}$$

$$\text{Where: } k_1^{-2} = \frac{md^2}{I_x}$$

$$k_2^{-2} = \frac{md^2}{I_y}$$

$$\text{For Dynamic Stability: } 0.0 < S_d < 2.0 \text{ \& } S_g > \frac{1}{S_d(2 - S_d)}$$

#### Equation 4: Dynamic Stability Equation

##### Where:

$C_{N\alpha}$  = Normal Force Coefficient Derivative per Sine Angle of Attack

$C_X$  = Drag Coefficient

$C_{npa}$  = Magnus Moment Coefficient Derivative WRT Nondimensionalized Spin and Angle of Attack

$C_{n\alpha}$  = Aerodynamic Moment acting perpendicular to the plane of the projectile angle of attack, not related to projectile spin rate

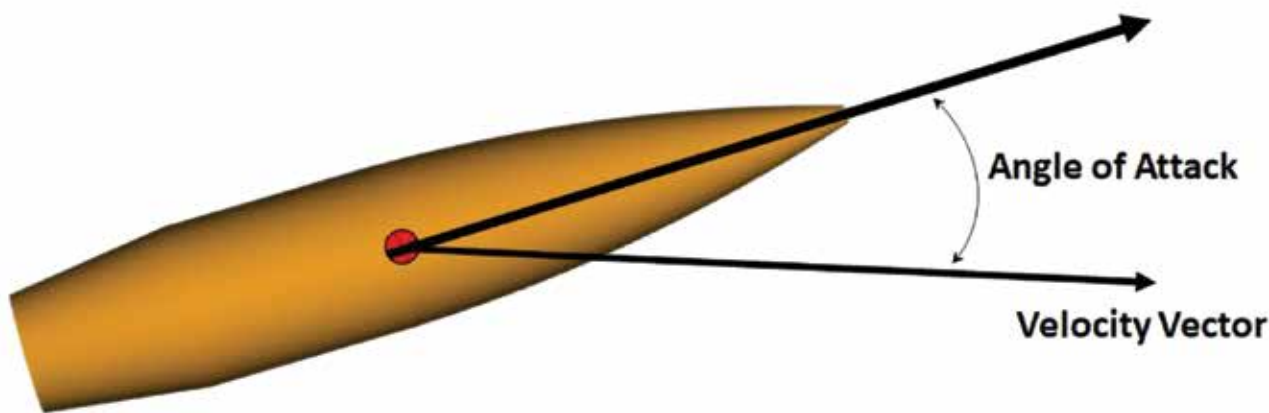
$C_{mq}$  = Pitch Damping Moment Coefficient

$C_{lp}$  = Roll Decay Moment Coefficient

$m$  = projectile mass



Figure 2: Projectile Flying with an Angle of Attack



$d$  = projectile aerodynamic reference diameter

$I_x$  = projectile polar moment of inertia

$I_y$  = projectile transverse moment of inertia

Here, the balance between the Magnus Moment coefficient derivative ( $C_{np\alpha}$ ) in the numerator and the Pitch Damping Moment coefficient ( $C_{mq}$ ) in the denominator is the determining factor in determining stability. If the Magnus Moment Coefficient derivative is too large, the projectile exhibits a "slow arm instability"; while if the pitch damping moment coefficient is too large, a "fast arm instability" results. Most rifle bullets are both gyroscopically and dynamically stable at the muzzle, and once the bullet drops to subsonic velocities, a small "limit cycle dynamic instability" of 3-5 deg. typically develops due to the dramatic increase in Magnus Moment in the subsonic flight regime. This dynamic instability slightly increases the total drag operating on the projectile in the subsonic flight regime, but it does not prevent the bullet from being used. All bullets of the same shape will exhibit nearly identical magnitude limit cycle angle of attack, making the bullet flight path fairly repeatable.

The effect of crosswinds on the projectile flight path is relatively easy to calculate in a closed-form manner, using either the Siacci approach or other approaches. The drift due to crosswinds is proportional to the difference between the projectile time of flight to the target in air (a factor with the units *seconds*), minus the time of flight of the bullet in a vacuum, multiplied by the velocity of the crosswind operating in a direction perpendicular to the projectile line of travel (a factor with the units of *FPS or meters per second*). Compared to 6 Degree of Freedom (6 DoF) trajectory results, the closed form crosswind drift result is accurate to very small error.

While the BC methodology can give reasonable estimates of the "nominal" projectile drop and remaining downrange velocity, it is limited because it only provides a macroscopically accurate picture of how the projectile flies. The Siacci method does not calculate how the projectile might deviate from its intended flight path due to launch disturbances, nor does it indicate anything about its stability, or how that varies with range. Projectile gyroscopic stability is assumed when the Siacci approach is used to compute bullet trajectories and any in-flight dynamic instability presents as an increase in total drag. The Siacci method also doesn't compute the "yaw of repose," an angle that develops between the projectile axis and the velocity vector that pushes the nose of the projectile to the right (for bullets fired in guns with right hand twist rifling), and makes the bullet drift to the right as it flies downrange (a.k.a. "spin drift"). For trajectory schemes using the Siacci approach, other calculations must be made to compute the "spin drift." Fortu-

nately, "spin drift" is linearly proportional to ballistic drop, simplifying drift calculations.

Regarding more microscopic details of projectile flight, it is widely thought that as the projectile emerges from the barrel, it flies perfectly point on for the whole trajectory to the target, with the bullet longitudinal axis exactly aligned with the velocity vector for the whole flight. This is an idealized mental image of a small caliber projectile in flight on its way to the target, and is not quite totally correct. This model is missing information focused on the in-flight orientation of the projectile longitudinal axis relative to its velocity vector, as shown in *Figure 2*.

To more accurately model the details of projectile flight behavior, a more sophisticated trajectory model is required. The "gold standard" of trajectory simulations is the validated 6 Degree of Freedom (6DoF) trajectory code. The projectile equations of motion can be written in either earth fixed or projectile body fixed coordinate systems, but all can model the motion of the projectile in pitch, yaw and roll, in addition to the 3 earth fixed coordinates, X, Y & Z. A close approximation of the 6DoF flight behavior can be provided by a 4DoF trajectory code; here the 6DoF equations are simplified to account for important factors such as aerodynamic jump in the vertical plane due to firing in crosswinds, as well as the drift due to the "yaw of repose." The 4DoF can also compute the gyroscopic stability of the projectile during the trajectory, provided projectile mass properties and a complete set of aerodynamic coefficients are known or can be accurately estimated.

*Figure 1* shows an instantaneous "snapshot" of a projectile flying downrange shortly after launch. Projectiles flying with the longitudinal axis perfectly aligned with the velocity vector (e.g., zero angle of attack) at all points in the trajectory are exceptionally rare; most exhibit some degree of "wobble" early in the flight. The average maximum angle of attack of a small caliber projectile in flight is usually less than about 3 degrees.

In practice, nearly every projectile "wobbles" some, particularly so at muzzle exit. Initially, the projectile axis is not perfectly aligned with the velocity vector, and the nose of the bullet traces out a (hopefully) decaying complex spiral similar to that shown in *Figure 3*. *Figure 3* shows the motion of the nose of the projectile relative to the velocity vector at reference 0,0.

The projectile wobble (yawing motion) is one of the dispersion sources that concern shooters; the frequency of the yawing motion is related to its aerodynamic and mass properties, as well as the projectile design and manufacture. The magnitude of the wobble (a.k.a. maximum initial angle of attack, in degrees) and the direction of the initial angle of attack (around the clock, looking downrange) is a variable shot-to-shot, and the variability of angle of attack and

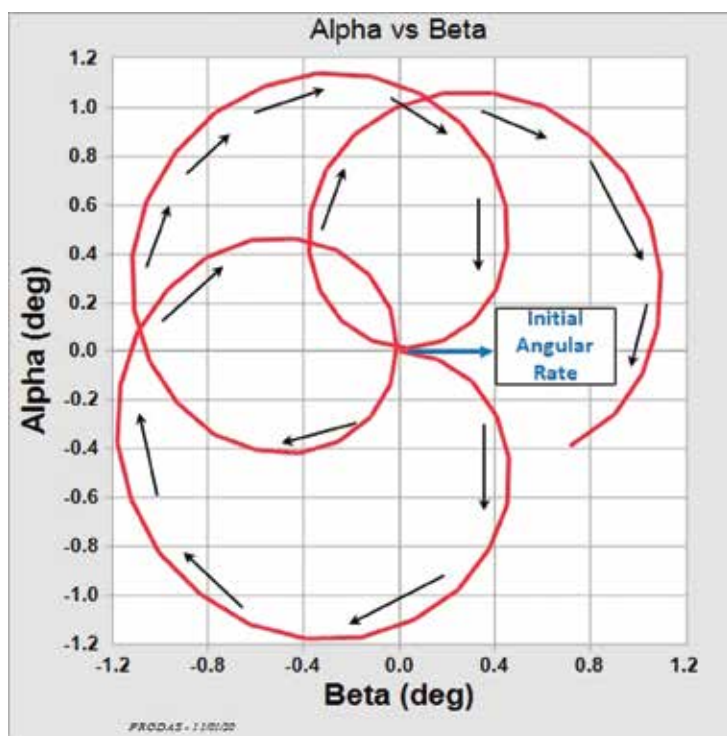


Figure 3: Projectile Yawing Motion (Looking Down Range)

direction is a dispersion source that concerns most shooters. In Figure 3, the initial angular rate disturbance to the projectile is in the horizontal plane, as shown. The black arrows around the figure show the motion of the nose of the projectile with respect to its velocity vector as it flies downrange.

It should be mentioned that some uninformed individuals cling to the mistaken belief that any evidence of bullet yaw (e.g., non-circular holes in the target) is hard and fast evidence that the bullet is "unstable," or worse yet, "tumbling." This is *not* the situation for all bullets exhibiting an angle of attack at short range. For rifle bullets fired supersonically, only a small bit of non-circularity of holes should be expected to be seen in the target. The vast majority of these are both gyroscopically and dynamically stable. For rifle bullets fired in the subsonic flight regime (e.g., .300 Blackout), these bullets are typically gyroscopically stable, but may be **dynamically unstable at zero angle of attack at launch**. As previously mentioned, most of these will exhibit a dynamic instability "limit cycle" between 3-5 deg, and that in-flight yaw will persist to the target due to this dynamic instability. A large number of pistol bullet shapes likely fall into this category of "gyroscopically stable



Figure 4: Projectile Drift vs. Range

but dynamically unstable" category.

As the wobbling projectile, with motion similar to that shown in Figure 3, flies downrange, the trajectory is curved in the vertical plane by the action of gravity. The trajectory curvature in the vertical plane caused by gravity, combined with the gyroscopic moment arising from the projectile spin and inertia, make the projectile nose point slightly up relative to the velocity vector as the bullet flies to the target. The projectile nose pointing up relative to its velocity vector induces an angular rate on the projectile, and if the spin is in the "right hand" sense (spin axis aligned with the right-hand thumb, the direction of rotation aligned with the fingers of the hand). The projectile angular momentum makes the bullet point nose right (again right hand sense, thumb aligned with the velocity vector, index finger pointed up, middle finger pointed right). The right-hand pointing bullet nose causes higher pressure on the left side of the bullet, making the bullet "drift" to the right for right hand twist barrels. Since the projectile yawing motion well separated from the gun can be considered to have "gone to sleep," the right hand pointing of the projectile from the combination of gyroscopic moment and trajectory curvature is known as the "yaw of repose." The yaw of repose causes the pressure to be slightly higher on the left-hand side of the bullet, pushing the bullet to the right as it flies downrange. The motion of the projectile to the right is known as "drift" (a.k.a. "spin drift"). Figure 4 shows the drift to the right (negative Y) due to the yaw of repose.

"Slant" in Figure 4 is short for "Slant Range," which is the total distance from the launcher to the projectile.

Projectile yawing motion during flight, shown in Figure 3, comes from an in-bore tilt of the projectile centerline with respect to the barrel centerline. The in-bore tilt can be caused by manufacturing defects, or it can be generated during the projectile jump from the cartridge case to the forcing cone of the barrel. At muzzle exit, the misalignment of the bullet axis with the bore axis makes the bullet "wobble" around the velocity vector as it flies downrange. This wobbling is responsible for the lion's share of the shot-to-shot scatter at the target known as dispersion. A more complete mathematical model of projectile flight, using the whole host of aerodynamic coefficients just introduced is required to make these computations. Data from relatively recent Doppler radar testing has been analyzed to extract the variation in projectile drag near the muzzle, which is related to the variation of initial angle of attack immediately upon exit from the barrel. If it is assumed this variation is drag near the gun muzzle is caused solely by bullet "wobble," an estimate of the bullet in-bore angle of the bullet with respect to the bore axis can be made. For well made "match bullets," the in-bore angle is estimated to be less than 0.10 deg. In flight, the largest projectile angle of attack relative to its velocity vector is usually less than about 3 deg. unless there are some significant problems with the projectile.

Since the yawing motion of the projectile varies in magnitude and direction shot-to-shot, the resultant motion causes flight path deviations, leading to impact point scatter at the target called dispersion. The desire to simulate the effect of yawing motion on projectile flight path is why trajectory simulations were improved over the years. Today's analytical tools are able to simulate the flight motion of any projectile, provided accurate knowledge of its initial conditions is provided. **SADJ**





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Nicaraguan Mechanized Infantry with German Mi-KM AK.

# Controversial Small Arms Swaps in Central America

By Julio A. Montes

**I**n August 2020, two former Salvadorean defense ministers and leaders of the most important national commercial weapons trader were arrested by the Civilian National Police in El Salvador. They had been accused of defrauding the govern-

ment in a weapons swap that ended up with the Salvadoran Army receiving two unworkable 155mm howitzers in exchange for thousands of weapons.

In the latest Salvadoran case, the weapons swap appears to have included weapons supplied by the

U.S., such as HK-41 / HK91 rifles and M14 rifles, as well as M1 carbines and M1 Garand rifles. Certainly, general David Munguía Payés acknowledged that the Army gifted four of the 92 weapons that Mauricio Funes, the former president (now on the run for





U.S. DoD ROMERO TAVERAS

#### Nicaraguan COE Commandos with Galil MAR acquired through GIR SA.

theft), amassed. Pictures of the gifted weapons show a Thompson submachine gun, one M14 rifle and an M1911 Colt that have been donated by the U.S. Those weapons could not be trafficked, gifted or donated to third parties without the consent of the U.S.

The swap or exchange of weapons is a widely-used instrument among the countries in Central and South America to exchange older weapons for newer models, to collect money for other projects, or even to make space in their warehouses. Unfortunately, many of these activities have been plagued with corruption. The Salvadorean Army, for instance, got rid of most of its historical weapons inventory for peanuts while military officers charged with pricing the guns for sale personally benefited from them. For instance, Salvadorean air enthusiasts still reel when commenting about the disposal of the last FG-1D Corsair for a couple of Cherokee station wagons in the early 1990s.

#### The Otterloo Incident

Panamanian officials in the past have been in the center of a huge scandal that involved the Nicaraguan National Police as well. As it happened, in its

July 16, 2003 edition the local newspaper *La Nacion*<sup>1</sup> reported that a batch of 150 rifles, presumably destined for Colombia, had been seized by the Panamanian police on a farm in the community of Santa Clara, in the province of Coclé, about 200 kilometers east of the capital. The arsenal included 144 AK-47s and 10 PKMs, together with 1,714 rounds of ammunition. A few months earlier, in March, the police had

seized ninety-eight AKMs, nine RPGs, one SMG, four 40mm grenade launchers, one RPD, one T-65 and four pistols. All of these weapons were destined to feed irregulars in Colombia. At the time, Carlos Barés, PNP Commander, referred to an arsenal acquired illegally using false documents from the Panamanian Police to purchase the arsenal from the Nicaraguan army.

On April 26, 2002, Michelle Lescure,



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#### Nicaraguan soldiers armed with AKM rifles.





COPREFA

Salvadoran policewomen with FMK-3s. The Army traded 2,446 "new" and 2,157 "used" FMK-3 SMGs.



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Salvadoran Commandos from COPARU (Reaction Company) of the former National Guard with M1D in 1988.

correspondent for the *World Press Review*<sup>2</sup>, wrote that a huge illegal arms shipment landed in Turbo, a port on the Gulf of Urabá on Colombia's Atlantic coast, in November 2001 and the shipment ended up the hands of the United Colombian Self-Defense (AUC) militia. A member of the AUC high command boasted to the newspaper *El Tiempo* in its April 25 edition that the AUC have fooled the authorities of four countries, obtaining 7,000 AK-47 rifles, USD \$5 million worth of 7.62mm bullets and "other assorted deadly paraphernalia." The shipment arrived on board of the *Otterloo*, a Dutch ship flying the Panamanian flag.

Indeed, the *Otterloo Incident*<sup>3</sup> was a transaction finalized in November 2001 that ended up delivering 3,000 AKM rifles and 2.5 million rounds of ammunition from the Nicaraguan Army to illegal Colombian groups. It turns out that the company Grupo Internacional de Representaciones (GIR, S.A.), based in Guatemala, made contact with the Nicaraguan National Police (PNN)

looking to exchange thousands of AKM rifles in exchange for 100 Mini UZI submachine guns and 465 Jericho pistols with their respective accessories, including military odds-and-ends to include belts and pouches. GIRSA had been in turn contacted in early

2000 by Shimon Yelinek, who claimed to represent the Panamanian National Police (PNP) and that he was interested in acquiring 5,000 AKM rifles, 1,000 Dragunov sniper rifles, 1,000 PKM machine guns, 1,000 RPG-7 rocket launchers and 10 million 7.62x39mm



OSWALDO MARENCO

Pope-mobile police escorts with FMK-3 in El Salvador. The 2,446 "new" FMK-3s were confiscated as part of the investigation.



rounds for the AKM to equip the PNP. The PNN offered 5,000 AKMs, which were rejected because they were in bad condition. The Army stepped forward, offering 3,000 new AKMs in its place, and this offer was accepted. As it happened, in the 1980s, the then EPS (or Sandinista People's Army) received in excess of 100,000 AKM rifles from various sources, including in excess of 15,000 specimens of the superb Mi-KM AK rifle from East Germany. At the end of the war in 1990, there were quantities of weapons still in storage, so the Army delivered 3,115 AKM rifles and 2.5 million rounds of ammunition to finalize the transaction with GIRSA, and for that they were paid a total of about \$250,000. With this, the guns that had initially been priced at \$70 dollars for the original, old guns would end up costing around \$30 for new ones.

The Otterloo, from the Panamanian Trafalgar Maritime Inc, entered Nicaragua on October 26, 2001, and set sail from the Nicaraguan port of El Rama on November 2 with its cargo, heading to Puerto Turbo in Colombia. In January 2003, the final investigative report from the special commission of the Organization of American States (OAS) blamed Nicaraguan authorities for the debacle. Nevertheless, Franco Montealegre, head of the Nicaraguan National Police (PNN) during the Arnoldo Alemán government, stated that the aforementioned order was delivered by the Nicaraguan Army to the National Police on October 11, 2001, a month after he had left the PNN. With the departure of Montealegre, the follow-up operation was overseen by his replacement, Edwin Cordero Ardila, and the former inspector general of the Army, Roberto Calderón Meza. The Nicaraguans were able to produce a copy of Purchase Order No. 954-00 from Panama's Ministry of Government and Justice accepting receipt that the weapons had been delivered to the PNP by the Nicaraguan Army on October 11, 2001<sup>4</sup>. That indicates that the PNP took possession of the load at the Nicaraguan port. The implication at the time was that Panamanian officials diverted the delivery; nevertheless, the American State Organization blamed the Nicaraguan Police for the oversight.

Nevertheless, GIRSA would carry out an additional weapons swap in 2002—this time directly with the Nicaraguan Army—for 5,000 rifles and 17 million rounds of ammunition. This time the



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Salvadoran National Guard member with OD M1971 uniform—basically the same Prussian model adopted in 1921 in khaki—and G3 rifle.

Army acquired some 500 weapons, to include Israeli-made Mini UZIs, Galil MAR rifles, and Chilean SAFs to equip the Special Operations Command (COE), and other specialized weapons.

### Salvadorean Swap

One of the arrested individuals in El Salvador in August 2020 was former Defense Minister general José Atilio Benítez Parada. The general had been Military Attaché in Madrid, Bonn, Paris and London in 1992 and by 2007, as

an artillery colonel, he was in charge of the Cuscatlán IX battalion in Camp Delta in Wasit, Iraq. In 2009, he was appointed General Inspector before being tapped as deputy defense minister by Mauricio Funes in May 2009, with General David Munguía Payés appointed minister. Funes, representing the former leftist guerrilla group Farabundo Marti National Liberation front (FMLN), had been elected president over the candidate from the





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The Army traded 1,873 M50 Madsen SMGs. Spare parts were available in Brazil, where the weapon was manufactured by INA.

rightist Nationalist Republican Alliance (ARENA). General José Atilio Benítez Parada became defense minister from November 23, 2011 to 2013, while general David Victoriano Munguía Payés moved momentarily as minister of

public security. With the return of Munguía Payés to the head of Defense in 2013, Benítez Parada retired for a bit and then became ambassador in Madrid from May 15, 2014 to April 24, 2015, moving immediately after as

ambassador in Berlin.

For all his accolades, general Benítez Parada was known for being smug and arrogant, and others knew that he liked to take weapons from the armory to trade. In mid-2016, the Salvadoran General Attorney's office filed charges against him for arms trafficking, and in December 2016 of that same year the Legislative Assembly (Salvadoran Congress) agreed to withdraw the immunity conferred to him as ambassador of El Salvador in Germany. As it happened, colonel Salvador González Quezada, who served as Director of Logistics of the Ministry of Defense between 2010 and 2011, had been presented by the Attorney General as a witness against the general. González Quezada confessed that he had followed the general's orders to falsify documentation related to at least 15 AK-47s and M16 rifles in order to legalize and register the guns so they could be sold. In fact, the former general was charged with irregular registration of some 29 weapons, which he trafficked at prices of around \$4,000 and \$6,000 each. González Quezada refers to the fact that he and others received orders from Benítez to alter and refurbish the weapons, and then put them in the name of the general to be able to register them and then traffic them. The colonel received a share of the profit from the sale of the weapons.

Gonzalez Quezada confessed that

Salvadoran  
155mm M71  
howitzer.



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CCP

Salvadoran Zastava M56 howitzer in combat.

the rifles came from the Armed Force warehouses, and were weapons seized during the civil conflict. However, González Quesada was removed from his post in November 2011, after he refused to register a Steyr assault rifle that had come directly from the Armed Force's own inventory in Benítez's name. The witness also stated that Benítez at the time facilitated the registration of weapons to former President Mauricio Funes, who was given 92 weapons of war upon his escape to Nicaragua. Consequently, the general is being prosecuted for fraud, arbitrary acts, illegal possession and carrying of firearms and illegal trade.

### Diplomatic Weapons

While serving as a Salvadoran diplomat in Europe, general Benítez Parada negotiated a number of items for the Salvadoran Armed Forces. The Salvadoran Army was supplied with over 300 examples of the elderly and cumbersome M67 recoilless rifle. These needed to be replaced since a few have had catastrophic failures when being fired during exercises. Therefore,

several hundred Instalaza C-90 were acquired and upon arrival were kept in secret. Ironically, the Army had seized dozens of RPG-7s from the guerrillas in the 1980s, and the Special Forces Command had exchanged its M67 for the RPGs. Although a great weapon, the C-90 is more in line to replace the elderly and obsolete M-72 LAW. Logistically it would have been logical to have acquired additional RPGs to replace the M67 instead.

General Benítez Parada also negotiated a batch of HK-121 machine guns. The weapon is better known as the MG5, as adopted by the German Army. Again, although it is a great gun, the MG5 was logistically an illogical choice. The Salvadoran Army has already received small quantities of M240B machine guns from the U.S. and has over one thousand M60 machine guns in inventory, some 600 of them new. A more logical move would have been to spend the money in upgrading the M60s in M60E4 and M60E6 with kits. Modified to the E6 standard, the M60 would have been able to soldier on for

another 50 years in Salvadoran inventory.

The general simply had no good aim. *The Military Balance*, published in February 2016 by the International Institute of Strategic Studies, specified that the Salvadoran Army had 18 Oto Melara Mod.1956 howitzers (page 398) in inventory. Effectively, the general negotiated the transfer of 18 Mod.1956 with the Spaniards. These are 105/L14mm examples phased out by the Spanish Army. The idea was to replace them with the Yugoslavian M56 howitzers, since they were about to be discontinued from Salvadoran service. The general could have chosen a more appropriate item from the Spaniards' stocks. The Salvadoran Army needs to replace its 120mm mortars, or complement its M40A1 recoilless rifles with a few additional examples, or even a few BMR600/VEC (armored reconnaissance vehicles) to replace the UR-416 APCs and recycle the H90 gun turrets from the AMLs, or even former Spanish UR-416s to complement those at home. However, general Benítez





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#### Oto Melara Mod 1956 acquired in 2016.

Parada chose the Mod.1956, which has less range than the Salvadoran's M101A1, M102 and M56 howitzers<sup>5</sup>, and fails to provide any additional capabilities to the Army. By the way, the M56 is contemporary to the Mod.1956, and it is a more robust and capable weapon. Moreover, the local Logistical Command (CALFA) had already developed the capability to restore and refurbish the M56 for a fraction of the cost of moving the howitzers from Spain to El Salvador.

CALFA had worked hard to renovate the elderly weapons back to service, but the Defense Ministry refused to provide the funds to restore the remaining 17 M56 howitzers. CALFA could have brought it from its original form in caliber 105/L28mm to M56A1 standard, with an L33mm barrel to provide for a range of 18km—a 8km range increase over the Mod.1956. CALFA could also do the same to the M101A1 to give it the same range, but now there is no money for such projects.

#### Swapped Weapons

Regarding the weapons exchanged that caused the arrests in August 2020, Defense delivered 23,306 firearms with a value of \$3,277,097. However, the original contract<sup>6</sup> defined the delivery as only 14,930 firearms, 27,721 magazines, 2,706,472 rounds of 7.62mm cali-

ber ammunition and 9,800 spare parts for G-3 rifles for a value of \$2,051,893.

The arms swap between the Ministry of National Defense and Centrum S.A. de C.V. (weapons trader in El Salvador) began during the administration of General Atilio Benítez and ended in the second presidential term of the FMLN, under the management of General David Munguía Payés as Defense minister. In January 2013, General Atilio Benítez established a review commission with six senior military officers to define the weapons and their cost to be exchanged with the company Centrum. The foregoing was in contrast to the prices already established by the Armed Forces Logistics Support Command (CALFA) in August 2011 by orders of the former Defense Minister, David Munguía Payés.

A batch of 2,446 "new" 9mm caliber FMK-3 submachine pistols were repriced at \$200 each for a total of \$489,200, but the report issued by the CALFA established that these SMGs were valued at \$480 each, which meant a total of \$1,174,080. Benítez's commission repriced 2,157 "used" FKM-3 submachine guns with a unit value of \$240 for a total of \$517,680, and added 709 G-3s in good shape, repriced to \$250 each; it is noted that some 150 of them were really "new" (unused) examples, all for a total of \$177,250. The swap included 1,873 M50 Madsen 9mm sub-

machine guns, each valued at \$240 for a total of \$449,520. The total value of the weapons used was \$1,114,450.

Presidential Legal Advisor, Javier Argueta, assured the local press that the entire process that led to the arms exchange between the Salvadoran government and the Centrum company in 2013 is full of irregularities. He pointed out that the value went from \$480 per weapon to \$200 after general Benítez shuffled commission members who were analyzing the swap, which was reduced, at first, to half of the goods that would receive a change: "From \$8 million it drops to \$4 million, and after authorizing and awarding the swap, out of nowhere, the price of each weapon dropped to \$42, or \$2 million for the complete transaction."

According to the charges, once Centrum achieved the trade-in contract, it changed it from delivering new howitzers, as originally agreed, to deliver refurbished examples instead, assembled from parts of various guns. That is how the Salvadoran Army got two Soltam M71 Model 1980, caliber 155/L39mm. Indeed, production of the M-71 howitzer ceased years ago. Argueta added that the Defense Ministry's delegation sent to inspect the guns to Israel got a demonstration of the weapons firing to a distance of only 200m instead of the required 23km that



Yugoslavian M56 105/L28 and M56A1. 105/L33

was supposed to take place<sup>7</sup>. Another irregularity would occur when Centrum charged the local VAT to the Ministry of Defense, as the two howitzers had received presidential tax exemption.

Investigators into this case indicate that the former presidents Mauricio Funes and Salvador Sánchez Cerén, both from the FMLN, gave the go-ahead to the negotiations to exchange obsolete armament of the

Armed Forces for newer ones<sup>8</sup>. However, similar weapons swaps took place during the tenure of Antonio Saca, from the rightist ARENA faction, who is in jail for swindling over \$350 million. Funes fled to Nicaragua, also charged with stealing another \$350 million. On August 19, 2019, Jimmy Alvarado wrote for *El Faro* that Sánchez Cerén had copied Funes' mechanisms to secretly funnel \$147.96 million<sup>9</sup>.

Certainly, the latest weapons swap

was authorized in 2013 by general Benitez, and the howitzers arrived in El Salvador in 2016, when General Munguía Payés accepted the product. The howitzers, however, were retained by Customs until 2018, when they finally arrived at the Artillery Brigade and were declared to be useless due to the lack of ammunition and spare parts. The scandal broke when a new government and a new Defense minister took over in late 2019. **SADJ**

1. <https://www.nacion.com/el-mundo/encuentran-150-fusiles-en-panama/6HYFDR6l6NHODFWFE7PHSF4CDE/story/>
2. <https://www.worldpress.org/Americas/531.cfm>
3. <http://www.smallarmssurvey.org/fileadmin/docs/A-Yearbook/2008/en/Small-Arms-Survey-2008-Chapter-04-EN.pdf>
4. <https://www.panamaamerica.com.pa/nacion/revuelo-en-nicaragua-por-desvio-de-armas-78308>
5. [https://sill-www.army.mil/firesbulletin/archives/1987/JAN\\_FEB\\_1987/JAN\\_FEB\\_1987\\_FULL\\_EDITION.pdf](https://sill-www.army.mil/firesbulletin/archives/1987/JAN_FEB_1987/JAN_FEB_1987_FULL_EDITION.pdf)
6. <https://www.elsalvador.com/eldiariodehoy/corruccion-defensa-entrega-armas-menor-precio/744144/2020/>
7. <https://www.transparencia.gob.sv/institutions/mdn/travels/8031>
8. <https://diariolahuella.com/funes-y-sanchez-ceren-avalan-permuta-de-armas-que-dio-origen-al-fraude-de-gustavo-lopez-davidson-al-ministerio-de-la-defensa/>
9. [https://elfaro.net/es/201808/el\\_salvador/22235/S%C3%A1nchez-Cer%C3%A9n-copi%C3%B3-mecanismos-de-Funes-para-gastar-en-secreto-\\$14796-millones.htm](https://elfaro.net/es/201808/el_salvador/22235/S%C3%A1nchez-Cer%C3%A9n-copi%C3%B3-mecanismos-de-Funes-para-gastar-en-secreto-$14796-millones.htm)





# Nighthawk Custom's Korth



The Crimson Trace CMR-207G Rail Master Pro offers a powerful 400 Lumen LED white light and green aiming laser in a compact and durable unit. The CMR-207G features an aluminum body with ambidextrous activation points.

# NXR .44 Magnum Revolver

Story & Photography by Todd Burgreen





The Korth NXR revolver has rails everywhere—top and bottom of the barrel. The bottom rail has Korth-provided weight installed.

# Old World Meets New

**T**he title of the article is not a misprint. Two premier/respected gun makers from each side of the Atlantic, Korth and Nighthawk Custom, have joined forces to offer the U.S. market something a little different in the form of the Korth NXR .44 Remington Magnum (.44 Magnum) revolver. Before the reader turns the page with a condescending snort—"What more can be written about a revolver?"—I ask for a chance to explain.

The double action revolver is due its respect as a masterpiece of 19th/20th century firearm design. Most treat it more as an anachronism than something worthy of attention in today's market. There is something different about the Korth NXR revolver that draws interest—maybe age is creating nostalgic feelings.

The German-made Korth NXR revolver, chambered in .44 Magnum, immediately attracts attention with its unique aesthetics. In fact, it shocks the

visual senses. You know it is a revolver ... it just screams "different." First, there is the large metal frame covered in DLC (diamond-like carbon coating) sporting the Turkish Walnut grips. The seam between the two grip halves is difficult to see. This is typical of the craftsmanship found on the Korth NXR. The grips are not merely aesthetic. Their design makes shooting full-house .44 Magnum loads more manageable.

The Korth NXR evaluated herein features a 6-inch barrel (4-inch model also available) surrounded by vented barrel housing. The Korth NXR has an integral accessory rail machined under the barrel. This can be used for a light and/or a laser. Korth sends a detachable weight if the end user wants to install it, beefing up the 55.3oz of metal/wood that already make up the NXR. This weight is more applicable for competition purposes. More rails are present over the cylinder and barrel. Anything thought as worthy to mount on a handgun can

be accommodated. Here is a revolver with flair.

Korth revolvers are accessible in the U.S. via Nighthawk Custom. The collaboration is bringing a new standard of revolvers to the American market. Korth's approach to manufacturing is similar to Nighthawk Custom's—one gun, one gunsmith. The commensurate price tag for the NXR reflects this. Its metal and wood fit and finish is impeccable and its smoothness of operation is something to behold. The cylinder glides in both double action and single action manipulation. Double action trigger pull measured 7.5 pounds, single action 3.2 pounds.

Adjustable iron sights are present with blacked-out notch rear sight. The ramped front sight is a serrated black blade featuring dual removable side panels. The Korth NXR's cylinder release lever is located just to the left of the hammer versus the more typical frame-mounted method. This placement is a Korth hallmark. The design





Even the speedloaders for the Korth are above the norm, with an all-aluminum one arriving with the NXR.

and positioning of the cylinder release allows shooters to open the cylinder without breaking their grip on the gun. The Korth NXR might be a revolver, but it has features worthy of the 21st century.

### On the .44 Magnum

Though .44 Magnum is no longer the king in terms of pure power, it is the established benchmark for handgun hunting cartridges. Sure the .454 Casull, .475 Linebaugh, .480 Ruger, .50 AE and now the .500 S&W surpass it in terms of delivered payload, but all pay homage to the .44 Magnum by comparing themselves to it. Manufacturers know that hunters and shooters are totally familiar with what the .44 Magnum brings to the table in terms of power. What better way to get across their own cartridges' capabilities than by making comparative statements like "xx percent more power than the .44 Magnum," etc. If a properly constructed bullet from a .44 Magnum, placed in the correct location, does not do the job, then no pistol cartridge will likely be successful either.

The .44 Magnum was the end result



The Crimson Trace Brushline Pro 2.5-8x28 optic, mounted with Wheeler Engineering rings, assisted in wringing out the Korth NXR's accuracy.

of years of tuned handloading of the .44 Special. The .44 Special, as well as other large caliber handgun rounds (such as the .45 Colt), were being loaded with heavier bullets and pushed at higher-than-normal velocities for better hunting performance than anything

offered by ammunition manufacturers. Elmer Keith, a prominent writer and outdoorsman of the early 20th century, is integrally linked with the development and introduction of the .44 Magnum, as well as the S&W Model 29. Early on, Keith settled on the .44 Special



The Korth NXR evaluated herein features a 6-inch barrel (4-inch model also available) surrounded by vented barrel housing. Rails are present over the cylinder and barrel. The revolver features adjustable iron sights with blacked-out notch rear sight.

The ramped front sight is a serrated black blade featuring dual removable side panels.



cartridge as the basis for his experimentation rather than the larger .45 Colt, for a variety of reasons. The selection of .44 caliber projectiles for handloaders was more varied and .44 special brass was thicker and stronger than the dated .45 Colt case. Significantly, the .44 Special case was smaller in diameter than the .45 Colt, meaning the .44 caliber revolvers had thicker, therefore stronger, cylinder walls than the .45 Colt. This is an important consideration when contemplating loading beyond specifications yet avoiding catastrophic failure. Keith advocated for a ".44 Special Magnum" with a 250 grain hard cast bullet at 1,200 feet per second. Ammunition companies were afraid of "heavy loaded" .44 Specials blowing older model revolvers apart. The answer was similar to the .38 Special/.357 Magnum solution to the same conundrum. Keith asked for a new cartridge a tenth of an inch longer than the .44 Special to preclude it from being used in any old revolvers or any new models chambered in .44 Special versus the higher-powered .44 Magnum.

When it comes to marketing products it is assumed newer is better, thus the spate of increasingly more powerful cartridges being released, touting themselves as the latest and greatest. Actually, if you look closer you will find that the excessive recoil of the new "souped-up" handgun cartridges is a



The Korth NXR has integral accessory rail machined under the barrel. This can be used for light and/or laser. Korth sends a detachable 6.53oz weight, if the end user wants to install it, beefing up the 55.3oz of metal/wood that already make up the NXR.

detriment to the most basic of marksman principles—shot placement. For nearly all but the most seasoned of handgun hunters, cartridges developed to surpass the .44 Magnum in terms of power often prove too much of a challenge in terms of managing recoil and blast. The .44 Magnum combined with today's modern bullets represents what most shooters can stand in terms of power/lethality while still being able to shoot well.

### Testing

There are many fine factory loads existing for the .44 Magnum from Black Hills Ammunition, Winchester and Hor-

nady. A plethora of bullets exist, ranging from 180 grain up to 300 grains and beyond. Black Hills 240 & 300 grain JHP, Winchester 210 grain Silvertip & 250 grain PTHP and Hornady 300 grain XTP are excellent examples of .44 Magnum ammunition flexibility. The NXR's 6-inch barrel produced 1,200+ fps with 240 grain loads. The accuracy was more than acceptable when combined with the Crimson Trace Brushline Pro 2.5-8x scope, with groups averaging 2.5 inches at 50 yards.

Some individuals are just more comfortable carrying a revolver. This can be based on various factors rang-





A SIG SAUER ROMEO1PRO red dot mounted on top of the Korth NXR.

ing from prior training, familiarity with revolvers, sense of the inherent reliability of revolvers compared to semi-automatics (this is not a debatable point), no external controls necessary to get a revolver into action, ability to better manage trigger control with a double action revolver or greater physical requirements of operating an automatics slide compared to a revolver's operation.

I decided to utilize the Korth top and bottom rails to explore various after-market sighting systems. Various manufacturers were turned to for red dots, magnified optics and light/laser combos. Trijicon for their RMR® red dot, SIG SAUER for the ROMEO1PRO and Crimson Trace for their Brushline Pro 2.5-8x28 optic and CMR-207G green laser/tactical light. There is certainly nothing wrong with the Korth iron sights. However, an opportunity to handle a revolver like the Korth NXR only comes around so often—I wanted to maximize its features.

I decided to take advantage of Echo Valley Training Center's 300 yard stepped berm Range #1 with steel targets scattered its length. As long as a solid shooting position could be found, accurate fire with the Korth NXR was



There is certainly nothing wrong with the Korth NXR iron sights. Here is a sampling of 25-yard offhand work.

the norm. The BOG™ DeathGrip tripod proved its worth for this evaluation. Anecdotally, it was not beyond the realm of possibility to smack one of Echo Valley Training Center's steel targets at 100 yards with the .44 Magnum Korth NXR with either open sights or one of the red dots from Trijicon or SIG SAUER mounted.

The distinct sound of a 240 or 300 grain bullet smacking steel is gratifying. For a pistol cartridge, .44 Magnum ballistics are relatively flat out to 100 yards. A 300 grain .44 Magnum bullet will drop 12 inches after 150 yards and 32 inches after 200 yards. The Crimson Trace Brushline Pro 2.5-8x28 optic, featuring BDC reticle, proved potent



.44 Magnum power should never be discounted—even now, in the age of extreme pistol calibers.



beyond ranges initially thought viable, especially when combined with the BOG DeathGrip tripod. Attention to detail rewarded regular hits on steel man targets at 200 yards. Strikes at 300 yards were experienced as well; though not at nearly the same percentage rate thanks to over 100 inches of bullet drop and windage influences that needed accounting for at that distance. It was still enjoyable to try, though. The revolver, combined with the walnut grips, produces only moderately-felt recoil. While more than 9mm, the .44 Magnum Korth would not be labeled as harsh or severe. This is where the .44 Magnum shines as not being overly punishing, unlike some of the recently-introduced handgun cartridge behemoths.

Opposite the long-range spectrum, a dueling tree placed 10 yards away had its steel panels flipped back and forth with ease when firing from the hip, thanks to the bright, easily-discerned Crimson Trace CMR-207G green laser. The Trijicon RMR and SIG SAUER ROMEO1PRO markedly improved the effectiveness of the revolver in rapid action drills involving plate racks and steel popper targets. The biggest advantage derived from using the Trijicon RMR and SIG SAUER ROMEO1PRO reflex red dots is that both eyes are open when engaging targets.

The Korth NXR was not only tested from static positions, but also from fallen trees and other obstacles along Echo Valley's "Jungle Walk" range. Once engagement distances reached 50 yards

## SPECIFICATIONS

### KORTH NXR .44 MAGNUM

**TYPE:** Single action / double action revolver

**CALIBER:** .44 Magnum

**CYLINDER CAPACITY:** 6

**BARREL:** 6in, 416R hammer forged

**OVERALL LENGTH:** 11.65in

**HEIGHT:** 6.38in

**WIDTH:** 1.72in

**WEIGHT:** 55.3oz

**FINISH:** DLC Coated

**GRIPS:** Turkish Walnut

**SIGHTS:** Adjustable iron sights/Rails to mount optics

**PRICE:** USD \$5,299.00

and beyond, it was time to mount the Crimson Trace Brushline Pro 2.5-8x28 optic in lieu of red dots. Optic choice really depends on the intended role and accuracy levels required for the Korth NXR by the user. The cycling of multiple sighting systems contributed to a thorough evaluation of the Korth NXR revolver and, frankly, was rather fun.

We must be aware not to view all weapons through a strictly tactical lens. Too many types of firearms exist and provide enjoyment for tactical application to be the only litmus test of validity. What role is this revolver intended to satisfy? As with most

things related to firearms, the answer depends on individual desires and/or whims. The Korth NXR .44 Magnum is a custom revolver designed to excel. The ability to mount red dot, magnified optic, light and/or laser combined with reliable, simple functioning and one-shot stopping power is a premium. Getting the chance to handle a revolver like the Korth NXR will remind us that not all handguns need to be semiautomatic and carry 15 plus rounds in order to be viable. **SADJ**

## WEBSITES OF INTEREST

Nighthawk Custom  
[nighthawkcustom.com](http://nighthawkcustom.com)

Crimson Trace  
[crimsontrace.com](http://crimsontrace.com)

Black Hills Ammunition  
[black-hills.com](http://black-hills.com)

Echo Valley Training Center  
[echovalleytraining.com](http://echovalleytraining.com)

Hornady  
[hornady.com](http://hornady.com)

Winchester Ammunition  
[winchester.com](http://winchester.com)

SIG SAUER  
[sigsauer.com](http://sigsauer.com)

Wheeler Engineering  
[wheelertools.com](http://wheelertools.com)

Trijicon  
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# SHOW REPORT: DX KOREA 2020

Story & Photography by Heebum Hong



S&T Motiv's anti-drone jammer, rifle mounted. The jammer itself is from another company.

**I**n South Korea, there are many defense-related events and exhibitions, but two of them are major events which also gather considerable international attention; one is ADEX (Aerospace & Defense Exhibition) and the other is DX (Defense Expo) Korea. They are biannual defense exhibitions, with DX Korea held in even years ADEX in odd years.

In 2019, I wrote a report on ADEX—now it's time for DX Korea 2020. But the year 2020 was, as everyone knows, far from ordinary. COVID-19 was all over the place, and so many major global defense shows were cancelled

and/or went virtual. But even in that turmoil there were a few exceptions, and one of them was DX Korea.

While many international guests and exhibitors couldn't come to Korea due to the travel restrictions (foreign visitors could come in, but they were required to quarantine for 2 weeks before doing anything and that in itself was a big hurdle for most visitors), the DX event itself managed to open in person due to the considerably low number of COVID cases in South Korea. Korea rarely had more than 1,000 new cases per day, and during late November of 2020, when the DX

event happened, the average new cases per day was around 300.

Of course, that doesn't mean it went just as usual. The date itself was postponed once, from the original late September dates to November 18-21. Anyone who went inside had to put on a mask and the entrance queue took longer than usual due to a body temperature check and social distancing. The scale of the exhibition itself was somewhat reduced due to the reduction of foreign exhibitors. But actually holding an in-person defense exhibition during 2020 itself was a very unusual thing, so I think



*Above and left:*  
D.I. Optical's day-  
night reflex ther-  
mal sight for the  
20mm Vulcan.



S&T Motiv's K5 conversion with Vortex Optics micro dot, weapon light and compensator.



Special forces operator (dummy), equipped with warrior platform equipment and garments.

it's worth writing an article about it.

### **S&T Motiv**

This year, in terms of the small arms sector, the most dramatic changes could be seen at S&T Motiv's booth. Unlike in other years, they not only displayed their weapons, they made many changes. They were YouTube livestreaming with a few gun-friendly celebs and they also made some diorama-like displays with weapons painted in tactical color schemes (painted by experts).

Other than adapting to a new way of managing events, S&T Motiv didn't show many different things compared to their 2019 ADEX exhibition dis-

play—but one new thing they had was the STSM-21 SMG.

Many people don't know this, but S&T Motiv has designed a few 9mm SMGs and machine pistols during the last 20 years. Only the K7 suppressed SMG would become an actual product. Many others, like the XK-9 or XK-10, couldn't make it past a few prototypes, or even a simple mockup.

We don't know what STSM-21 will be because it's just a prototype, but unlike previous ones, it shows some potential. It is a simple blowback operated 9mm SMG, but with some modular and modern features like an ambi-selector, M-LOK interfaces and

an MPX-style stock (handguard can also be removed with a simple latch). Also, its size shows S&T Motiv is most likely making this into a 5.56mm carbine. You can look at the magwell size to deduce this.

S&T Motiv also displayed their most



# SHOW REPORT: DX KOREA 2020



Hanwha Defense's unmanned combat vehicle.

recent variant of the STC-16 with 14.5-inch barrel. While the STC-16 failed to be adopted by Korean armed forces at this time, they still hope to export them. The bolt catch and mag release are now ambidextrous and were displayed with a new version of the K201 grenade launcher with MIL-STD-1913 rail interface.

S&T Motiv is also trying to get into the drone countermeasure market. They teamed up with other Korean company and put some jammers on their rifles. Counter-drone operation is very serious nowadays in virtually all of the armed forces and Korea is no exception. S&T Motiv is trying to have a share in this new market.

## Dasan

Moving on, we see another Korean firearms company, Dasan. While they've won a big prize with their DSAR-15PC, they didn't show many new products this year. One new thing



S&T Motiv made a desert-themed display to catch the attention of potential buyers.



S&T Motiv STSM-21 9mm submachine gun.



Dasan's Double Switch pistol, 9mm. Using an 18-round magazine with 1911 hybrid frame, this pistol may have some good potential for the U.S. market.



S&T Motiv's STC-16 with 14.5-inch barrel and grenade launcher.

they showed was the DSAR-16P with a 6mm ARC round. Dasan brought this new caliber with their short-stroke gas piston platform with a 16-inch barrel.

### D.I. Optical

D.I. Optical, a Korean firearms optics company, showed a new day-night sight for the naval 20mm Vulcan cannon. This is basically a reflex-type sight during the day and at night a thermal camera screen appears on the sight picture. 20mm Vulcan is a considerably old weapon system and its current night vision sight is very obsolete, one which dates back to Vietnam War era.

### ROK Army

ROK Army showed new "Warrior Platform" systems, which is the equip-



Dasan DSAR-16P rifle, using the 6mm ARC round.



# SHOW REPORT: SHOW REPORT: DX KOREA 2020

ment purchased under the program of the same name. This program is an infantry modernization program, from helmet to boots, with new firearms optics. For the optics, this program requires a red dot sight, magnifier for the red dot and laser sight similar to the U.S. military's PEQ-15. All of them are from Korean suppliers. The red

dot is from SU OPTICS, a new Korean optics company who won the first contract for this. I hope to write an article about this soon.

One thing this year's DX Korea expo lacked was a firepower demonstration. COVID and many other things restricted the overall scale of this year's event. But considering most of 2020's shows

were cancelled or virtual, DX Korea was unusual on its own. And even with the threat of COVID, only a few cases were reported at the DX Korea site.

This year (2021), ADEX 2021 is supposed to take place on October 19-24. Let's see if Korea can do major in-person defense exhibitions every year—even during the pandemic. **SADJ**



This year, DX Korea had to reduce its scale considerably.

## DX KOREA 2022: Show Master Info

### Next Dates

September 21-24, 2022

### Website

[dxkorea.org](http://dxkorea.org)

### Location

Almost exclusively held at KINTEX, a convention center near Seoul.

### Transportation

Close to subway station (Daewha), a 3rd line (Orange line). From the Incheon airport it usually takes less than an hour.

### Accommodation

A few hotels are near KINTEX, but not many. Most of the official hotels partnered with KINTEX are in Seoul. Luckily, most official hotels provide free shuttles to the attendees and exhibitors.

### Electricity

220V, with EU type 2-prong plug

### Safety

South Korea is one of the safest countries, with a very low violent crime rate.

### Tourism

You can visit many interesting places in Seoul—there's a very large war memorial museum, which is worth visiting.

### Other Tips

Avoid weekends and Friday to visit. Most of the visitors are there during those 3 days, especially on Saturday and Sunday (public days).

**NOTE:** All information subject to change. Go to [dxkorea.org](http://dxkorea.org) for up-to-date information.

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# The Difference Between Ballistic Coefficients and Drag Coefficients Obtained From Doppler Radar

*What do they mean, what do they do for you and how does it help with accuracy?*

By Ward W. Brien

**F**or over two centuries, precision rifle shooters have vigorously sought out freedom from error, exactness, and have set their search for the perfect bullet. A method for determining bullet performance and also the use of ballistic software is based upon two methods: **ballistic coefficients** and **drag coefficients** (obtained from Doppler radar).

The **ballistic coefficient (BC)** of a body is a measure of its ability to overcome air resistance in flight. In other words, the higher the BC, the less drag it has, shooting distances may be extended, and it has a greater terminal velocity on target.

Most precision shooters should look for a bullet that has a multiple number of high ballistic coefficients.

## How Ballistic Coefficients Are Calculated

This empirical data, **ballistic drag coefficients**, must first be measured. These measurements are the deceleration rate of the bullet in flight and must then be converted into **ballistic coefficients**.

In order to accomplish this, there must be a device to measure the bullet speed. If two different speeds are measured at close proximity, (1,000 yards and 1,050 yards) the two speeds are different because they are slowing down. The difference between those speeds and the amount of time that passes between the two measurements tells you the rate of deceleration. If you

know the cross-sectional density of the bullet, the rate of deceleration can now be turned into a **drag coefficient**, and once the drag coefficient is established, a formula is then used to calculate the bullet's **ballistic coefficient(s)**, and the BCs relate the drag of that bullet to a **reference drag curve**.

Ballistic coefficients are corrected to sea level (0') and at 59° F (15° C), and are most always provided by the bullet manufacturer. However, obtaining the bullet's BCs requires the use of one of three atmospheric models (models are a group of equations). These three atmospheric models are:

1. The "U.S. Army Metro" Model, which was developed in the 1930s and 1940s, and improved in the 1950s;
2. The "International Civil Aviation Authority," (ICAO), which is utilized today and is an international legal requirement for aviation;
3. The Thermal Dynamic model, which has the greatest accuracy of the three, and is a method that measures gases such as  $NO_2$ ,  $O_2$  and  $H_2O$ .

Some bullet manufacturers produce "laddered" BCs, which is mandatory when using ballistic targeting software, i.e., a .30 caliber, 220 grain "Sierra Match King" as noted by Sierra, provides three BCs, which are as follows:

BC = .629 @ 2,100 fps and above  
BC = .624 between 2,100 and 1,700  
fps

BC = .608 @ 1,700 fps and below

This is where things get interesting.

There are many equations, "formulas," and also "drag models" within the ballistic software. The two main drag models used today are the G1 and the G7. These two drag models represent two different kinds of bullets; the G1 is a blunt nose bullet and the G7, a pointed bullet. The G1 and G7 are *incomplete averaged* models that are in desperate need of "help," and this is where the BCs come in.

The lower Mach numbers, (1.6 and below), do not match up well with a bullet that only has one BC and needs several more BCs to correct for the divergence. This is, in part, why Sierra's bullets have multiple ladder BCs that work well out to the transonic region, which is the intermediary portion of the trajectory in between supersonic and subsonic velocities.

The ballistic coefficients are a multiplier and are multiplied to the "averaged" G1 or G7 drag models to correct for their inadequacies. Again, this is done within the ballistic software in an attempt to create an accurate drag curve or trajectory, thus producing elevation and windage solutions for your distance to target.

Ballistic targeting software, such as X-RING, Lapua's 6DOF and Hornady's 4DOF, all do this. However, the software must have additional information to compute the solution, and that information in part, consists of your current meteorological data, (MET), i.e., the current temperature, barometric station pressure and humidity.



**Doppler Radar Head**

Technically speaking, BCs calculated at sea level and in the one temperature of 50° F, change when you are shooting at different density altitudes. (Density altitude is derived from the combination of temperature, barometric station pressure and humidity). The software takes this into account and calculates the changes for you. However, I only know of one ballistic targeting software package, called X-RING, that will correct for the changing BCs when shooting up or down from one altitude to another; i.e., 10,000' ASL down to 8,000' ASL.

So how does Doppler radar come into the picture and what exactly is it?

A **Doppler radar** is a specialized radar that uses the "Doppler effect." Regarding a bullet, the radar produces thousands of pairs of time and velocity data points throughout the bullet's trajectory. It does this by measuring the frequency of the bullet's trajectory from start to finish, utilizing hundreds of small, (approximately 1cm) sized antennas that are in a dynamic phase array, creating exact data of the trajectory and is no simple feat.

The measurements are very precise and must be accomplished with a certain number of Doppler radar heads, in a controlled environment and out to a velocity of approximately Mach

.8 and below. According to X-RING's author, MIT Astrophysicist, Dr. Lyman Hazelton, Doppler data can be utilized below Mach .8. The Doppler radar data plus the mathematics and algorithms within the ballistic software generate a trajectory life cycle of the bullet. Any other method delivers incomplete and less valuable data.

Once the *raw* Doppler radar drag data of the bullet is complete and incorporated into the ballistic targeting software, the accuracy of the solutions can be extraordinary. I say "can be" because there are two practices of taking advantage of the raw radar drag data.

1. Utilizing Doppler radar to generate BCs that are then multiplied to the existing G1 or G7 drag model(s) populated within the software;
2. Utilizing the "raw" Doppler radar data via mathematics and algorithms within the ballistic software will deliver extraordinarily accurate solutions.

The Doppler radar drag curves (blue lines) in *Figure 1* were accomplished with approximately six Doppler radar heads out to a distance of 3,000 meters. Because we have a complete profile of the drag curves, you can see how they do not match up, and that there is a catastrophic divergence oc-

curing at approximately Mach 0.95.

The thousands of pairs, (time and velocity throughout the trajectory), of raw data, which is accurate to within a few microseconds, can now be utilized to calculate the bullet's ballistic coefficients.

This means that the bullet's BCs, along with one of the base atmospheric models, (U.S. Army Metro, ICAO or the Thermal Dynamic Model), the radar, geographic and met data, i.e., latitude, longitude, compass heading, Coriolis, inclination and declination of aim, the cross-sectional area of the bullet, wind speed and direction, can be used in formula and multiplied to the G1 or G7 drag models to correct for their divergence.

The second method utilizes the raw ballistic Doppler radar data directly. However, the software must be intelligent enough to accomplish the task.

The bullet manufacturer, Lapua, does a fantastic job acquiring the Doppler radar data and the X-RING ballistic software utilizes it very, very well. X-RING has the mathematics, algorithmic engine and proprietary architecture that optimize Lapua's raw Doppler radar data.

Two true stories of X-RING's accuracy are as follows. In the month of November, 2019, a friend of mine showed up



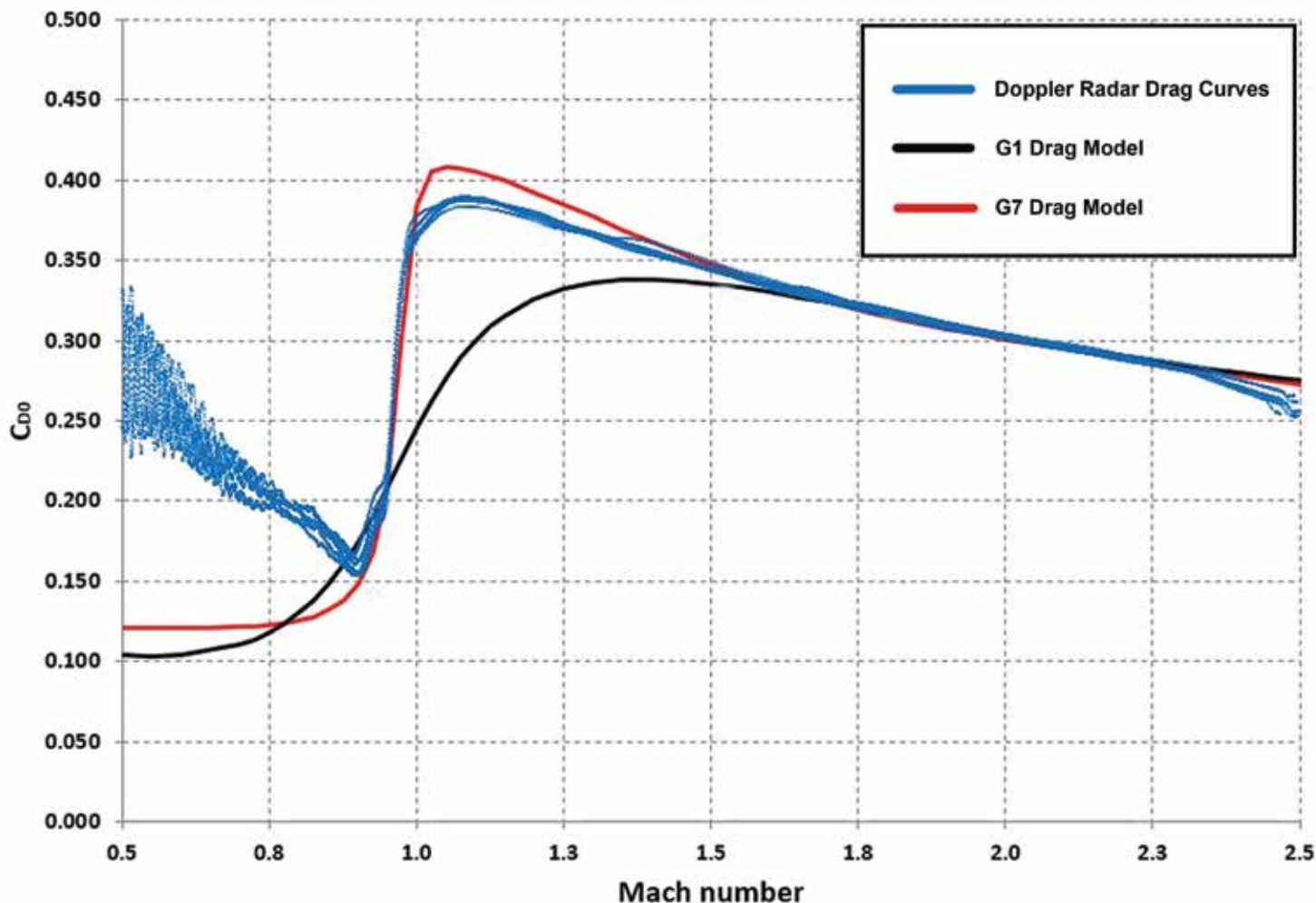


Figure 1. Drag Curve Chart

for a few days of shooting. He brought with him a .224 Valkyrie, along with his handloaded Lapua 90 grain .22 caliber bullets. To make a long story short, he made first round center mass hits out to 1,497 meters in 30-35mph winds. I kid you not.

One year prior, in 2018, at the Mountain Shooting Center, I was instructing a group of lead U.S. military snipers instructors. On the last day of the course, we were all sitting on range #13 looking down and across the large, ominous canyon. A young man who was helping me asked me in front of the snipers if he could take a shot at one of the targets. I was a little hesitant, however the group encouraged him on. I then asked, "Which target?" He said the one across the canyon—at 2,320 meters. He was shooting a 6.5 SAUM, utilizing a 142 grain Sierra Match King. I took a moment and recorded the wind speeds and examined the canyon for additional wind and optical anomalies. Utilizing X-RING, I

calculated two solutions for two different wind combinations.

"Mr. Sprinkle" settled into the prone position, slipped his turrets to the correct adjustment and waited for me to tell him when to send it. With all eyes on the target, after several minutes I told him to standby, followed by my command to send it. Approximately five to six seconds later, we all watched through our spotting scopes as the cold bore shot hit the 39" x 19.5" steel silhouette approximately one inch right of the center line and on the collar bone. I yelled out, "HIT!" and told him to quickly send another one before the wind changed. He quickly racked another round, aimed and fired; hitting the target again approximately five inches lower, (which was just about center) and one inch to the left of the center-line. Everyone there witnessed the hits and the extreme accuracy of X-RING ballistic targeting software.

The once-utilized "empirical models" of years ago are okay, kind of, although

they will only deliver short distance solutions out to maybe 800 meters. In my opinion, those solutions will have trajectory errors; both in the vertical and the horizontal/windage. On the other hand, the physics of Doppler radar is very precise and advanced and, comingled with the use of Lapua bullets and X-RING ballistic software, will deliver extremely accurate solutions.

So, that's the difference between ballistic coefficient(s) derived from one of the three previously-mentioned formulas and drag coefficients obtained by Doppler radar—and a little bit of the science behind the shooting. **SADJ**

## RESOURCES

X-RING Ballistic Software  
**empyrealsciences.com**

Lapua 6DOF Ballistic Software  
**lapua.com/resources/lapua-ballistics-app**

Hornady 4DOF Ballistic Software  
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Figure 1.1 A U.S.-made Gen3 G17 fitted with a Hogue "HandALL" aftermarket grip sleeve. Note the clear manufacturer's markings for Glock's Smyrna, Georgia plant. The curved "fish-gill" slide serrations denote a rare variant of the Gen3 pistol with the RTF2 frame texture.

# The Online Trade in Illicit Small Arms in Venezuela, Part 1

By Pedro Pérez, Jonathan Ferguson and N.R. Jenzen-Jones | Photos ARES CONMAT Database

## Introduction

A countrywide and total ban on the sale of small arms and ammunition to and between private individuals in Venezuela took effect in 2012,

codified by written legislation promulgated in 2013. From June 1, 2012, only agents of the state were permitted to sell firearms and ammunition. This has driven a new and thriving segment

within Venezuela's black market arms trade, which has proliferated primarily through social media and secure messaging platforms. Whilst the illegal arms trade certainly existed prior to



Figure 1.2 A Gen3 Glock 23 (.40 S&W) compact self-loading pistol with ported barrel and slide and aftermarket fiber optic sights.



Figure 1.3 A Gen3 Glock 21 (.45 ACP) full-size self-loading pistol sold with Glock case and two magazines.

the ban, it was primarily operated by and for criminal gangs. Post-ban, the market has evolved, with numerous private individuals without criminal ties now participating in interrelated and parallel black and “grey” markets.

According to confidential government sources in Venezuela, the number of illegal firearms circulating in the country has increased between 2009 and 2019. Given the increase in reported narco-guerrilla activity along the border with Colombia and the illegal gold mining operations near the border with Brazil, there is also a high probability that greater numbers of weapons have been smuggled into Venezuela from abroad over the past decades. Many of these have likely ended up in criminal hands, most

under the control of the organized criminal groups that control the illegal gold trade and the *trenes* (prison gangs) and *prans* (prison gang leaders) that control the penitentiaries. In addition to cross-border influences, the rise in *colectivo* (government-supported paramilitary group) activity is also believed to have contributed to an increase in arms trafficking, as well as an increase in the diversion of firearms and ammunition from military and police armories. *Colectivo* members thus have access to modern self-loading (including automatic) firearms, whereas they might otherwise be forced to rely upon obsolescent military firearms, civilian-type rifles or shotguns, or even craft-produced designs.

The illegal arms trade in Venezuela has traditionally operated as it has in most of the world; private individuals might make an illegal sale on a small scale, and dealers of varying sizes would service different segments of the criminal and broader markets. In more recent years, this translated initially to Facebook, but has since substantially migrated to private WhatsApp groups and then to broadcast lists. The private groups which initially existed on Facebook and spearheaded the arms trade on social media caught the attention of intelligence services. Many were successfully infiltrated, and most of them subsequently shut down due to fear of being prosecuted. Many of the core members of these Facebook groups migrated to WhatsApp, forming groups there, and using broadcast lists. Broadcast lists on WhatsApp (and similar functions on other platforms) operate in a similar fashion to the “blind carbon copy” (BCC) function in an email sent to many recipients—that is, the recipient of a broadcast list message can see the sender’s details, but not that of any other recipients. Replies from the initial recipient will not be seen by other recipients. A source in Venezuela shared with ARES a Policía Nacional Bolivariana (Bolivarian National Police, or PNB) intelligence report dated July 4, 2019, which extolls the successes of operations to infiltrate WhatsApp groups that facilitate the trade in arms and ammunition. Similar results have not yet been reported from operations targeting broadcast groups.

## Self-Loading Pistols

### Glock

Reflecting an increasingly global trend, Austrian-designed Glock pistols are the single most-sold brand of all firearms recorded during ARES research, representing 41% of all of the self-loading pistols observed. In fact, Glock products account for 27% of all small arms recorded in the ARES dataset. According to confidential sources, Glock has become the most sought-after brand in Venezuela, and a Glock handgun fitted with an automatic fire-selector and a 33-round magazine has become something of a prestige weapon. Some examples were customized with aftermarket slides, sights and/or accessories. The vast majority of the Glock handguns in the dataset are chambered for 9x19mm; the most common are the





Figure 1.4 What appears to be a new-in-case Gen5 Glock 17 full-size service pistol complete with interchangeable backstraps, cleaning kit and case lock.

models 19 (compact), 17 (full-size) and 26 (sub-compact), in that order. The remaining examples in order of popularity are the compact and full-size models 22 and 23, chambered for .40 S&W, and the (again, compact and full-size) models 25 and 21, chambered for .380 ACP and .45 ACP, respectively. The Glock pistols in the dataset were almost certainly all made in either Austria or the United States.

The dataset indicates that Glock pistols were usually priced between 1,000 and 1,700 USD. The lower end of that spectrum typically represents older first- and second-generation (known as Gen1 and Gen2, respectively) models, which were manufactured from 1982–c.2000. Later Gen3 and Gen4 models (1998–present) occupied the higher end of the spectrum. However, price also varied depending on the condition of the firearm, what accessories it was sold with, and the presence of any unique, unusual or desirable features. Models with colored or textured frames (such as Glock's "Rough Textured Frame," or RTF) and those which have been ported with a "compensator" are all relatively rare in Venezuela, and command higher prices. Glock handguns chambered for calibers other than 9x19mm are also typically more valuable, despite being much harder to obtain cartridges for.

There are only limited examples in



Figure 1.5 A Gen3 Glock 17 fitted into a CAA Roni stock/chassis and further accessorised with extended barrel, sound suppressor, TruGlo optical sight, extended ETS magazine and 33-round spare magazine.



Figure 1.6 A stolen Beretta 92F pistol offered for sale by CS2. The serial number on the left-hand side of the frame has been abraded.



Figure 1.7 Beretta pistols are commonly available in Venezuela, especially the 90 series. Seen here are two new-in-case Model 92FS self-loading pistols.



Figure 1.8 A U.S.-made Beretta 92FS handgun. Note the U.S. manufacturer markings and the distinct "BER" serial number prefix used only on U.S.-made firearms. The serial number indicates the weapon was produced in 1997.

the dataset of the more recent Gen4 and Gen5 models (introduced in 2010 and 2017, respectively), and prices for these far exceed the average due to their rarity. A former European firearms manufacturer's representative for Venezuela told ARES, "Gen4 models didn't exist when Glock stopped importing pistols to Venezuela, therefore, any pistols newer than Gen3 were, without a doubt, smuggled into the country." It should be noted that Gen3 models are still available from Glock.

A handful of Glock pistols were sold with "chassis"-type stock systems, designed to convert the weapons to function much like pistol caliber carbines or SMGs. The Israeli-made CAA RONI carbine kit for Glock pistols is a highly desirable accessory, typically selling in Venezuela for 1,000–1,500 USD. This chassis is usually paired with an extended magazine and a selector switch to assemble a makeshift SMG. A heavily accessorised Glock/RONI firearm is shown in Figure 1.5.

#### Beretta

Beretta handguns were the second most common brand, accounting for 23% of all self-loading pistols, and 16% of the total number of small arms recorded by ARES. The dataset shows that the most prevalent model was the Model 92 series, which has been issued to police and military units for many years in Venezuela, and has been historically popular among civilians as well. One notable example was a Beretta 92F pistol converted to be capable of automatic fire. The price was 500 USD—much lower than the average price (around 1,000 USD) for unmodified examples. The seller openly advertised that the pistol was stolen, explaining the lower price. The seller is a retired police officer and later worked in close personal protection roles for government officials. He explained that although he does not usually offer stolen weapons for sale, this handgun was of a class of weapons known as *material de apoyo* (support material). This Venezuelan euphemism refers to weapons that have been seized or confiscated in crimes and later repurposed for use in illegal or deniable operations by security forces.

The manufacturing situation with Beretta pistols is somewhat complex. Some models, including the Beretta 9000-series, were only ever produced in Italy. Conversely, the Px4 sub-compact model is only made by Beretta





Figure 1.9 One of three FN Herstal Five-sevenN pistols offered for sale. Both early (curved trigger guard, as here) and late (straight guard) types were represented. Note the prominent blue ballistic tips of the SS197SR 5.7 × 28 mm ammunition. Despite this, the cartridges were described by the seller as "armour-piercing."

USA and has never been manufactured in Italy. The more common Beretta 92-series however, has been made in both the U.S. and Italy. All standard models of Beretta 92-series handguns produced in Italy have a single-letter prefix (e.g. A, C, M) followed by a 5- or 6-digit numerical sequence, and end with a single-letter suffix (e.g. M, Z). U.S. marking schemes have varied, but differ from the Italian format, often by having either a numeral before the prefix letter, or by having multiple prefix letters (most commonly "BER"). The compact polymer-framed Px4 is another type in Venezuelan government use, and was also well-represented in the dataset. The vast majority of the Beretta pistols in the dataset are in 9x19mm, with the few exceptions being chambered for .380 ACP and .32 ACP.



Figure 1.10 Two derivatives of the Czech CZ 75 from the dataset: an IMI/IWI Jericho (left) and a Tanfoglio T95 (right).



Figure 1.11 An as-new Caracal F self-loading pistol (9x19mm) with case, three magazines, user manual and even its manufacturer-supplied trigger lock device. Note that this model is fitted with Caracal's proprietary Quick Sight system, a point-shooting sight reminiscent, in some respects, of the ASP Guttersnipe sights.

### FN Herstal

Belgian maker FN Herstal was somewhat popular in this dataset, with pistols including the legacy steel-framed Hi-Power model (9x19mm) observed. Two of these were found to be marked "*Fuerzas Armadas de Venezuela*," denoting appropriated military sidearms. Three comparatively modern Five-seveN pistols were also recorded. Although the 5.7x28mm cartridge is in use with Venezuelan security forces with both the Five-seveN and the P90 submachine gun, the pistol is also available on the civilian market in the United States, making it difficult to determine the source of these examples. The 5.7x28mm SS190 cartridge was conceived as a means for SMG-class weapons to defeat soft body armor. This was achieved via a rifle-style spitzer (pointed) type bullet providing greater "sectional density," and specific armor-piercing (AP)



Figure 1.12 One of two cased Strike One pistols (9x19mm) self-loading pistols from the dataset, this one finished and sold by Salient Arms in the United States.





Figure 2.1 Two generic M4-style AR-15-type self-loading rifles, both with longer (16-inch) barrels than the military equivalent (14.5in) and both fitted with non-standard “ergonomic” pistol grips. The bottom example also has the older style fixed carrying handle; not present on issue USGI M4 rifles.

loads (usually identified by a black bullet tip). The latter are not typically available to civilians, and indeed no “black-tip” ammunition was evident in photographs. Nonetheless, one of the weapons offered for sale was described as having “armour-piercing” ammunition. In fact, the photo shows magazines loaded with SS197SR sporting-purpose ammunition, that is not armor-piercing in nature. All cartridges visible in the available imagery had projectiles that were either unmarked—likely being either FN Herstal SS194, SS195LF or SS198LF types, or American Eagle TMJ—or featured the prominent blue polymer “ballistic tips” of the FN Herstal SS197SR cartridge.

### Other Self-Loading Pistols

Derivatives of the Czech CZ 75 were also popular in military circles, allegedly due to their robust construction and ability to withstand more powerful loadings of 9x19mm ammunition produced by CAVIM. Whilst only a single Czech-produced CZ 75 was recorded, several copies and close copies were documented. Notable amongst these are the Jericho/“Baby Eagle” pistols produced by IMI/IWI and those made by Italian firm Tanfoglio, especially their polymer-framed Force 99 model. Sixteen of these were documented in the dataset, many still in their original pistol cases. One was even supplied with a full set of polymer accessories suitable for a police



Figure 2.2 AR-15 rifle in a U.S.-legal “pistol” configuration, pictured with the SOB arm brace produced by U.S. firm SB Tactical, as well as a Strike Industries “cookie cutter” muzzle brake (or Chinese copy), Keymod modular handguard with flashlight and mount, EOTech reflex sight, MOE pistol grip (or clone) and single-point sling.



Figure 2.3 AR-15 rifle in a U.S.-legal “pistol” configuration built on a Diamondback DB-15 lower receiver with Magpul furniture and a “Drum Magazines” 42-round box magazine. The barrel lacks a muzzle device or any visible threading, suggesting that it may have been cut down.



Figure 2.4 A crudely finished and marked AR-15 lower receiver, purportedly produced by 'Tact. Offense', and most likely built from an 80% lower receiver within Venezuela .

"duty belt," including a retention device for handcuffs. ARES has had sight of a military order for Force 99 pistols, circa 2010, and other security services within Venezuela also make use of the weapon. It is highly likely that some, if not all, of the Force 99 pistols documented were stolen from Venezuelan security forces.

Other notable makes and models included in the dataset include Smith & Wesson Model 36 and derivatives (with only one of S&W's modern M&P range of self-loading pistols); the SIG SAUER P226/228/229 series; Heckler & Koch (HK) types, including the USP and derivatives; the .45 ACP Colt Government (1911) type; a handful of Walther P99 models; two Strike One pistols produced by Arsenal Firearms (one assembled and modified by Salient Arms); and the Caracal, in both F (full-sized) and C (compact) variants. The Caracal is a modern polymer-framed striker-fired self-loading pistol designed and made in the United Arab Emirates.



Figure 2.5 An AR-15 "pistol" build with completely unmarked lower receiver, one of a number likely produced from "80%" lower receivers.



Figure 2.6 A spuriously marked lower receiver, purporting to be a Colt "AR-15A2 Sporter II." Amongst other incongruous features, the Colt "logo" is a crude copy of the genuine version.



## Self-Loading Rifles

Rifles accounted for 12% of all the firearms in the dataset and self-loading rifles for 90% of all the rifles listed. Overall, the most common type encountered was the AR-15. These weapons command an average price of \$5,000 USD, whilst a minority of examples were offered around the \$3,500 USD price point. Many of these rifles were "80% lower" builds, and were either unmarked on the lower receiver, or were marked with distinguishable "local" markings. Sources within Venezuela indicate that the absence of markings and unknown manufacturer diminished an AR-15 rifle's price, whilst known brands such as Colt command a much higher price. This likely accounts for the examples of spurious markings—especially Colt markings, but also other U.S. "prestige" brands, such as Noveske—seen on some rifles. Due to the dominance of AR-15-type rifles, 5.56x45mm is the dominant caliber, accounting for 62% of all rifles. Other calibers include 7.62x39mm (16%), .22 LR (11%), 7.62x51mm (5%), .30 Carbine (3%), .30-30 Winchester (2%), .300 Blackout (1%) and .357 Magnum (1%).

## AR-Type Self-Loading Rifles

91% of the AR-15 variants encountered were chambered for 5.56x45mm caliber whilst the remaining examples were chambered for 7.62x39mm. Whilst AR-type rifles chambered for 7.62x39mm are somewhat uncommon worldwide, one might think that it makes more sense in a country where the issued rifle for the armed forces is chambered for that caliber. However, 7.62x39mm ammunition is extremely scarce on the illicit market in Venezuela, and sources indicate that rifles in the caliber are generally purchased only by those with connections to pro-

Figure 2.7 Also from the dataset, a genuine Colt AR-15A2 Sporter II with correct markings, valid serial number, and in original factory configuration.





Figure 2.8 A Palmetto State Armory PA-15 model rifle chambered for .300 Blackout, fitted with a short vertical front grip and a cheap Chinese red dot sight.

cure the correct ammunition.

FANB's standard-issue Kalashnikov AK-103 (7.62x39mm) self-loading rifles are supplemented by M4-pattern AR-15 models (5.56x45mm) and models. The M4-pattern rifles are readily distinguishable from unusual types like

the AR-57, but do pose an ID complication for more generic M4-syle examples that might find their way into the country by other means. M4-pattern AR-15 rifles were part of the dataset, but most of these featured 16-inch barrels, rather than the 14.5 of the mil-

itary "USGI" (U.S. General Issue) selective-fire equivalent. Such M4-style rifles are sometimes known as an "M4gery" in the U.S. civilian sphere. At least one example did have the correct 14.5-inch barrel, but was not entirely to military specification.



Figure 2.9 This "AR" build incorporates a skull-shaped lower receiver known as "The Jack," designed and produced by Spike's Tactical/ Sharps Bros in the United States. Like many others in the dataset, it is festooned with accessories.





Figure 2.10 One of two 7.62x39mm AR-type rifles in the dataset, with a Keymod-type handguard produced by U.S. maker BCM. The extreme curvature of the magazine is indicative of the chambering.

"Arm braces" are found on some of the AR-15 examples in the dataset. These include a range of manufacturers' products, such as the Blade "pistol stabilizer" produced by U.S. firm Shockwave and the SB Tactical SOB. These are noteworthy due to the fact that this is an accessory designed as a specific response to U.S. firearms legislation, which treats short rifles without a shoulder stock or a vertical foregrip to be sold as "pistols" (and therefore to be more readily and quickly purchased than short barreled rifles). Other examples in the dataset feature simple foam padding on their buffer tubes. These are all likely to be weapons configured as "pistols" under U.S. law, and are likely of U.S. origin.

Several recorded lower receivers were entirely unmarked, almost certainly as a result of "80%" manufacture. Others featured spurious markings. One had crudely applied markings for a purported company named, presumably, "Tactical Offense" ("TACT. OFFENSE"). No such company is known to ARES, could not be located in any online searches, and was not recognized by sources in Venezuela. As such, this is likely an 80% receiver or blank finished by a small workshop or individual gunsmith, most likely in Venezuela. The desert tan finish is a Cerakote product or similar. Other lower receivers appeared to be genuine U.S. imports, made by companies such as Palmetto State Armory of



Figure 2.11 U.S.-made Century Arms C39V2 AK-type self-loading rifles, sometimes called "AK Pistols." Note the large circular hole at the rear of the receivers. This is present on all Century "under-folder" receivers, regardless of whether or not the host rifle is sold with a buttstock fitted (in this case, they have not been).

South Carolina. Many of these firms do not offer an 80% lower option, suggesting that these lower receivers were purchased as finished, registered components (legally, as firearms in the U.S.) and subsequently exported to Venezuela<sup>1</sup>. In the case of the Palmetto State Armory rifle, this was not merely a lower receiver but a complete OEM PA-15 model rifle as supplied by PSA with 16-inch barrel, Magpul MOE furniture and back-up iron sights, the same pattern of M-LOK handguard and a pistol-length gas system. The latter identifies it as the PSA 16" 300AAC Blackout MOE M-LOK variant of the PA-15 (SKU 516444735)<sup>2</sup>. For the avoidance of doubt, the vendor included a photo of the PSA-trademarked shipping box.

Another AR-15 was assembled around a distinctive skull-shaped lower receiver—produced by Sharps Bros in the U.S.A.—finished in gold. These and other "custom" efforts and the generic nature of the AR-type self-loading rifles in the dataset are congruent with the known gunsmith assembly and hobbyist activity taking place in Venezuela. Confidential sources indicate that, much like in

the U.S., Venezuelan firearms owners favor the customizable nature of AR-15 rifles, and are often willing to pay gunsmiths to modify their weapons. These hobbyists also support a thriving market in accessories which, whilst beyond the scope of this report, includes a wide range of primarily U.S.-made items such as magazines, muzzle devices, optics, furniture (stocks, handguards, rail assemblies), laser aiming devices, illumination devices and more.

### AK-Type Self-Loading Rifles

A number of the AK variants found in the dataset were, like some of the AR-15 rifles, of a short-barrelled "pistol" configuration (lacking even an "arm brace"). This is suggestive of a U.S. origin, although stockless short-barrelled rifles are also popular elsewhere in the world for their concealability and aesthetic, and can be readily created by removing or cutting off the shoulder stock. The examples shown, however, are in new or near-new condition and appear to match the U.S.-made Century Arms C39V2 "AK Pistol." This identification is made on the basis of barrel length; the form and length of the gas sys-

tem; the combination of wooden handguard (with palm "swell") and Russian-style black polymer pistol grip; the unused (plugged) stock pivot point holes in the receivers; and the OEM use of Magpul PMAG 7.62x39mm magazines. The other AK-type self-loading rifle in the dataset was of generic AKMS pattern, with under-folding shoulder stock. No diagnostic features in terms of country of origin or manufacturer were evident. This weapon was both heavily used and highly modified, with railed handguard and top cover and an "A2"-style AR-15 pistol grip (with the necessary AK adaptor). As well as visible wear to the surface finish and a missing cleaning rod, its "slant" muzzle device was installed upside-down. **SADJ**

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*This article is adapted from the research report Black & Grey: The Illicit Online Trade of Small Arms in Venezuela published by Armament Research Services (ARES). For further information on the data gathering methodology and dataset analysis, as well as other original research, see **armamentresearch.com**.*

1. In this case the imported U.S. component is what is commonly known as a "stripped" lower (i.e., a complete, serial-numbered receiver sold without any additional components).
2. See <https://palmettostatearmory.com/psa-16-300aac-moe-m-lok-rifle-516444735.html>

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# Sabatti's Tactical EVO US

## Italian Precision, Made for America

By Pierangelo Tendas | Photography by Bruno Circi

**A** direct spin-off of Sabatti's own Tactical EVO bolt action long range rifle, the Tactical EVO US model has been specifically modified—departing from several objectives of the original design—to meet the unique demands of the U.S. law enforcement and civilian markets.

Regional differences do play a role in the development of specific products in all industries and business segments—and that's especially true on the firearms market. Whether it's due to legal restrictions applying in various jurisdictions or the different demand and tastes of shooters, hunters and operators in various parts of the world, it's hard for firearms manufacturers

not to take certain factors into account. Long story short—you have to give your customers what they want. And if you manufacture firearms, most of your customers will be in the United States.

The Sabatti S.p.A. company of Italy first introduced the Tactical EVO bolt action long range precision rifle in late 2019 as a modernization of their previous Rover Tactical Synthetic model. Launched officially during the 2012 edition of the EXA expo in Brescia, Italy, the Rover Tactical Synthetic was one of Sabatti's first products to be specifically and directly created for tactical applications and PRS shooting competitions, and featured what back then was the mainstay of the

company's production—the Rover hunting rifle action—on a 60% Nylon, 40% fiberglass stock that was made to maximize rigidity without compromising on the overall weight and featured a fully-adjustable cheek riser and a set of spacers for LOP adjustment.

Offered with the buyer's choice of a matte black or chrome finish on all metal surfaces, the Sabatti Rover Tactical Synthetic rifle (a.k.a. the "Tactical Syn" model) was available in calibers such as .222 and .223 Remington, .308 Winchester, 6.5x55mm, .300 Winchester Magnum and 6.5x47mm Lapua. Users could choose between standard or (brand new, back then) MRR multi-radial rifled barrels, in various lengths,

The black lightweight polymer stock of the Tactical EVO US rifle is crossed by multiple white veins, reminiscent of the captivating look of black granite.



with a 22mm or 27mm muzzle diameter.

The Sabatti Tactical Syn was part of a whole family of rifles, all featuring the same action, with different barrel and stock configurations to adapt to numerous different long range shooting applications, chiefly Benchrest shooting and precision hunting.

As the turn of the decade approached and feedback from civilian and professional users flowed in, the Sabatti company decided to upgrade the design by taking said feedback into consideration while at the same time implementing all the innovations in rifle-craft that Sabatti had developed entirely in-house during the intervening years.

The Sabatti Tactical EVO and Tactical EVO US bolt action long range rifles were announced back to back, and first showcased to the U.S. public at the 2020 edition of the SHOT Show in Las Vegas—the most recent edition that took place. The two rifles are substantially identical, but the latter features certain tweaks that were specifically made to the design to meet the unique demands of the North American market in general, and the U.S. in particular.

The Sabatti Tactical EVO and Tactical EVO US rifles are offered internationally both to civilian and law enforcement customers, serving a plethora of conventional and special tasks that go from standard long range shooting sports to PRS competitions, down to patrol rifle



A signature feature of the Tactical EVO US rifle—a set of spiral flutes are machined all through the surface of the bolt, making it even faster and more quiet to operate.



The cheek riser on the Tactical EVO US rifle is fully adjustable. A set of spacers can be used to adjust the length of pull on the buttstock.





The receiver of the Sabatti Tactical EVO US is drilled and tapped for optic mounts or rails, leaving it to the user to choose which kind of interface to adopt according to his or her needs.

service, urban sniping and countersniping, and overwatch applications.

### One Rifle, Two Versions

As we anticipated, the Sabatti Tactical EVO and Tactical EVO US are essentially the same rifle, the latter having being specifically retrofitted with some modifications that depart slightly from the baseline design to meet the specific needs of civilian shooters and law enforcement operators stateside, who generally require lighter weight and superior mobility.

This means, of course that the EVO and EVO US have a lot in common—features that they share with other rifles from current Sabatti production, most of which were discussed in a previous article about the ST-18 (a.k.a. the STR Overwatch rifle).

Both the Tactical EVO and Tactical EVO US rifles are based on the “Blizzard” action—Sabatti’s current flagship action design, the same as is featured on the STR Overwatch and many other hunting, sport shooting and tactical long range rifles manufactured at present by the company.

The Blizzard action essentially consists of a CNC machined, special steel alloy bolt with three locking lugs; the bolt body is heat-treated and chrome-lined to meet a set of very specific thickness specs that match a mirror set of specifications of the receiver, to achieve a fast, smooth and extremely silent operation (a must for tactical applications) with extremely tight tolerances.

Sabatti takes particular pride in this specific feature. The Blizzard action is as quiet to operate as one would expect

from a custom-built rifle, yet it comes on what is essentially a mass-produced industrial product. What we see in the typical Blizzard action is one of the highest levels of machining precision the firearms industry can achieve in a long range rifle that’s conceived from the ground up to be produced in series—not custom-made.

A very tight opening angle with a 60-degree bolt throw and a 5/16” thread at the end of the cocking handle (allowing the users to replace the factory knob with an aftermarket one of their choice) are also features that the Tactical EVO and Tactical EVO US share with other Sabatti rifles based on the Blizzard action.

What sets these two rifles apart, however, is the deep spiral fluting on the bolt body. Sabatti’s bolts in general, and particularly those found on rifles based on the Blizzard action, are marketed as offering superior resistance against wear and corrosion, and the fluting definitely adds up to that with a solution to keep any gunk out of the way, lest dirt may interfere with the normal operation of an action built on such tight tolerances.

Also standard with the Tactical EVO US, and with all rifles based on Sabatti’s Blizzard action, is a unique 17-4PH stainless steel extractor, fondly dubbed the “guillotine extractor” within the company due to its form and function.

We already discussed the design in the previous article about the Sabatti Overwatch rifle, but for those who may have missed it, the new extractor fully supports the chambered round and is designed not to move, or in any way give in, as the cartridge case expands at the base when the rifle is fired.

The new extractor design was adopted following feedback from long range shooters both in Europe and North America, who requested that a solution be found to prevent any potential case rupturing—a rare occurrence when using factory loads, it is much more likely to happen when using surplus ammunition, high-pressure loads or hand loads prepared with reused (and thus potentially weakened) spent brass. The design and specs of the new Sabatti extractor make sure that it supports the case at the rim with enough force to prevent it from rupturing under heavy pressures, ensuring safe and reliable cycling in all conditions.

The Sabatti Tactical EVO US and Tactical EVO rifles feature a two-position



Another view of the fluted bolt of the Sabatti Tactical EVO US rifle. The quick and silent operation is something that Sabatti takes a lot of pride in.

manual safety on the right side, just behind the cocking handle, and a bolt removal button on the left side of the receiver—a standard configuration for modern bolt action rifles. A visual and

tactical status indicator is also provided, in the form of a notch that protrudes from the rear of the bolt when the rifle is cocked.

The Tactical EVO US and Tactical EVO

rifles also share another feature with the aforementioned Overwatch—a high-strength, heat-treated steel receiver machined out of solid billet to rigid specs that are an exact match to



The Tactical EVO US rifle comes with QD sling swivel cups on the handguard and buttstock, on both sides.





The Sabatti Tactical EVO US features a standard two-position manual safety located just behind the action, on the right side, at quick thumb reach.

those of the bolt. Matte black or matte chrome options are available.

The rifle comes from factory with a machined alloy 17-slot Picatinny rail for optics, but the receiver is drilled and tapped so that the user may remove it and replace it with other options, if so inclined. Sabatti offers various rail options, including 10 MOA and 20 MOA inclined base rails for extended capabilities (sold separately, of course), but aftermarket rails will also fit.

The stock is one of the two features that tells the dedicated Tactical EVO US from the baseline Tactical EVO. In both cases we have a dedicated stock design, a direct evolution of the one used on the previous Tactical Syn rifle, entirely manufactured in Italy and available in desert tan or a captivating black finish with white veins that is reminiscent of the captivating look of black granite—because a true Italian product should *never* lack a touch of high-end aesthetics.

Both rifles also feature checkered surfaces on the grip and handguard, an adjustable cheek riser and a set of rubberized spacers for allowing the user to



The Tactical EVO US rifle features a Sabatti three-lever Match-grade trigger, which can be accessed for manual adjustment by removing the action from the stock.

adjust the length of pull while at the same time significantly reducing felt recoil.

Just like the STR Overwatch and other Sabatti rifles, neither the Tactical EVO nor the Tactical EVO US feature a standard bedding, going instead for the company's own "suspended

action" (*azione sospesa*, in Italian)—a proprietary system that has the receiver coupled to the stock only via two screws, staying essentially suspended over the stock as if on a cradle.

With no direct contact between the stock and the action outside of those



The Sabatti Tactical EVO US bolt action rifle, fully stripped.

two direct engagement points, both the action and the barrel are free to float within the stock. Coupling tensions are thus eliminated, benefiting overall accuracy.

The difference is in the manufacturing and a couple of key features. While the baseline Tactical EVO stock is manufactured out of the same Nylon/Fiberglass compound that made the Tactical Syn stock so successful in terms of rigidity and stability, the Tactical EVO US rifle stock employs a lighter polymer mix that makes the overall package from 400g (approx. 14oz) to about 1kg (2.2lbs) lighter than the baseline model.

The Tactical EVO US stock also features QD sling swivel cups on both sides of the handguard and stock, and comes from the factory with a bottom Picatinny rail portion for bipods—a feature which the Tactical EVO model is set up for, but is left to the end user to install.

The peculiar modifications to the stock and its implications on the overall weight of the package were studied to increase the mobility of the platform, both for tactical applications and for sporting purposes, chiefly precision rifle shooting competitions which are only recently starting to blossom in Europe, while they already enjoy broad popularity in the United States.

### Different Lengths, Same Core

Another difference between the Sabatti Tactical EVO and Tactical EVO US rifles is in the available barrel lengths; the Tactical EVO is offered with 26" or 28" barrels, whereas in the Tactical EVO US, it goes down to 22" or 26" respectively, bringing the overall length to a minimum of 42" to a maximum of 45" depending on the caliber.



Removing the action of the Tactical EVO US reveals the peculiar bedding system used by Sabatti: two single attachment points that keep the action "suspended" on the stock, leaving everything else free to float and eliminating any and all coupling tension.



The magazine well is integrated within the trigger guard assembly and features a prominent magazine release lever located underneath the guard itself.



Both the Tactical EVO and EVO US rifles employ cold hammer-forged, conic profile barrels with a matte black or chrome finish matching that of the receiver. All are MRR pattern barrels (Multi-Radial Rifling), a Sabatti exclusive based on a patented company technology, first launched in 2011 and characterized by a modified forcing cone geometry and less pronounced lands and grooves.

The different forcing cone geometry provides a better alignment of the bullet with the bore, while the peculiar rifling pitch engages the bullet in a tight fit that reduces the levels of friction; this, in turn, results in lower bullet deformation and absolutely no cuts.

On the industrial point of view and in terms of service life, the MRR rifling pattern allows for easy manufacturing of barrels through cold hammer forging, reduces rifling wear caused by attrition and minimizes the need for cleaning, although your usual, accurate level of cleaning is still necessary during the barrel break-in period, which by the way is noticeably reduced if compared to standard rifled barrels (approximately 200 rounds).

All MRR barrels are guaranteed by Sabatti to offer sub-MOA performance at 100 meters, and our tests show these claims to be true. As we previously did with the Sabatti Overwatch, we tested a Tactical EVO US rifle in central Italy using Fiocchi Perfecta ammunition, the commercial version of a dedicated load prepared by Fiocchi for Italian Army snipers, loaded with 168gr or 175gr Sierra Match King HPBT bullets.

The Sabatti Tactical EVO US comes with a 22mm diameter, 5/8-24 inch threaded muzzle, allowing easy installation of flash hiders, muzzle brakes (both aftermarket models and purpose-built options available separately from Sabatti) or sound suppressors.

### For All Uses

We tested our Sabatti Tactical EVO and Tactical EVO US rifles in the .308 Winchester / 7.62x51mm version, but both rifles are also available in 6mm and 6.5mm Creedmoor, .300 Winchester Magnum, 6.5x47mm Lapua, 6.5x55mm SE and .284 Shehane. That's enough to get all your bases covered in terms of tactical applications and long range shooting (including high-level competition) and even for hunting.

The Sabatti Tactical EVO feeds through proprietary single-stack detachable magazines, ranging from

## TECHNICAL SPECIFICATIONS

Manufacturer	Sabatti S.p.A.
Model	Tactical EVO US
Type	Bolt action rifle
Calibers and Rifling Twists	.308 Winchester / 7.62x51mm (1:11"), 6.5x47mm Lapua (1:8"), 6mm Creedmoor (1.8"), 6.5 Creedmoor (1.8"), 6.5x55mm SE (1.8"), .300 Winchester Magnum (1:11"), .284 Shehane (1:8.¼")
Action	Blizzard action—three front-locking lugs with 60° opening angle
Trigger System	Match-grade, three-lever
Safety	Manual safety
Capacity	AICS compatible magazines, 7 rounds
Sight Systems	MIL-STD 1913 Picatinny rail for optics
Barrel	22in or 26in conic profile 22mm diameter at the muzzle, MRR Multi Radial Rifling pattern
Overall Length	41in or 45in
Weight (Empty)	12.6lbs max.
Materials	Steel barrel, receiver, and action; reinforced polymer stock
Finishes	Matte black or chrome finish available on steel surfaces; stock available in black with white veins, or in desert tan

three to six rounds in overall capacity, depending on the caliber. The Tactical EVO US is instead made to feed through detachable AICS-compatible 7-round magazines. A magazine release lever is located in a convenient position within the trigger guard, in a lower frontal position, allowing shooters to swap mags and reload easily without losing eyes on target.

Both rifles come with Sabatti's own Match-grade three-lever trigger that breaks at an average weight of 600g (1.3lbs) and can be adjusted by the user upon separation of the action from the stock. The trigger is another feature that the Sabatti company takes pride in—a factory trigger that offers the same performance levels as those boasted by major aftermarket trigger suppliers. As of today, no aftermarket triggers compatible with Sabatti rifles are available from any maker, but if our experience means anything, you will not want or need an aftermarket trigger on your Sabatti Tactical EVO US—ever.

### Country-Specific? Not So Much ...

If a downside in the Sabatti Tactical EVO US rifle design has to be found it is that, due to the peculiar bedding system, no aftermarket supplier makes stocks available for this or other Sabatti rifles that could replace the factory stock. Which, after all, is not a big deal. The Sabatti Tactical EVO and Tactical EVO US rifles were engineered to be user-friendly to a maximum level and ready for competition or tactical applications right out of the box, with

minimal break-in.

Sabatti, however, operates a Custom Shop that allows shooters to arrange certain custom modifications to their rifle with the company. While it does sound a bit redundant—a company offers custom modifications to a rifle line that is advertised as offering custom-grade features and performance from factory—that's a testament to Sabatti's dedication to customers and their needs, worldwide. It's not unheard of, at Sabatti, to have the most requested custom modifications for this or that model turned into standard factory features for the next generation of rifles.

After an initial phase of exclusive availability on the U.S. market, the Sabatti Tactical EVO US has been made available internationally to commercial and professional customers alongside the baseline Tactical EVO. What was meant to be a strictly American import has turned into a mainstay of Sabatti's product line in a handful of months, enjoying a substantial market success on the European and other global markets, even in the difficult circumstances of a global pandemic. This goes to show that maybe, just maybe, shooters worldwide have a lot in common in terms of tastes and needs, regardless of where they live and practice.

The manufacturer's suggested retail price for the two models in Europe starts at EUR 1.600,00 € for the Tactical EVO and at 2.088,00 € for the Tactical EVO US. **SADJ**

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## Elbit Systems Launches E-LynX-Sat—A Portable Tactical SATCOM System

**Elbit Systems** has launched E-LynX-Sat, a compact satellite communications (SATCOM) add-on system. The new system utilizes a lightweight (less than 1kg) terminal that interfaces with Elbit Systems' E-LynXTM Software Defined Radio (SDR) solution. E-LynX-Sat enables infantry and maneuvering forces to maintain robust and secured, on-the-walk and on-the-move, voice and data communication services, over ranges of hundreds of kilometers. The operational benefits of the newly launched E-LynX-Sat system were successfully demonstrated during the British Army's recent Warfight-

ing Experiment 2020.

E-LynX-Sat integrates miniature phased-array antennas, unique satellite communication modem, beam steering and error correction software, as well as data compression protocols. Using standard Ka and Ku-band Geostationary satellites, it features automatic electronic satellite tracking and direct sequence spread spectrum, enabling continuous over the horizon operations on-the-walk and on-the-move. E-LynX-Sat is comprised of compact portable terminals and a Hub base station that is installed in satellite ground stations.

## Marathon Targets' Central Role in "Range of the Future" at Camp Lejeune

**Marathon Targets**, the global leader in providing autonomous robotic targets to militaries and law enforcement worldwide, played a central role at the December unveiling of USMC's G-36 range at Camp Lejeune. Defense media on both sides of the Atlantic quickly hailed G-36 as "The Range of the Future."

The range featured a platoon of 45 AI-driven autonomous robotic targets—Trackless Moving Infantry Targets (TMITs) assaulted by a company of Marines. The range was built in 5 months and cost only \$2.3 million, compared to five years and \$10-12 million for a conventional range— a 75%-80% reduction in cost and time.

**Military.com** quoted 2nd Marine Division Gunner CWO5 Joshua Smith describing how autonomous TMITs improved Marines' lethality by tripling or quadrupling their hit rate in a single day. Smith said "a Marine went anywhere from 20 to 30% hit rate on a moving target to 80 to 90% in just one day." Smith added, "Imagine, if I can do reps and sets like that all the time, how I could increase lethality at the individual level."

"Range 36 is indeed the 'Range of the Future,'" said Ralph Petroff, President - North America of Marathon Targets. "It has proven that a 'clean sheet approach' to future small arms live fire ranges will immediately improve individual lethality, while also decreasing the time and cost to upgrade ranges. It will likely become the template for all future DOD small arms ranges."

## KWESST to Hold First Live Demo of Non-Lethal Low Energy Cartridge System

**KWESST Micro Systems Inc.** (TSXV: KWE and OTCQB: KWEMF) announced that it will hold the first ever live demonstration of its Low Energy Cartridge (LEC) system. The demonstration will be held in the Whistler, British Columbia area in the afternoon of July 9th, 2020.

The LEC system is the world's first cartridge-based non-lethal firing system with universal application across

four market segments that currently use a variety of dated "non-lethal" or "less-lethal" solutions. These segments are (i) public order (riots and control of dangerous subjects), (ii) military and law enforcement training (realistic force-on-force training), (iii) personal defence (home, car, boat, RV, camping, hiking), and (iv) high-action gaming.

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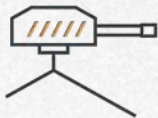
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